Pit and Quarry

With which is consolidated CEMENT-MILL & QUARRY

Member Audit Bureau of Circulations

Read in Largest Number of Plants

Vol. XXIII December 30, 1931 No. 7

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Vol. XXIII CHICAGO, DECEMBER 30, 1931 No. 7

Building in Central Northwest Increases

LOWER IN ALL OTHER AREAS

With only one important territory in the 37 states east of the Rockies showing a gain in new construction contracts, retrenchment in building and construction continued unabated during November according to F. W. Dodge Corp. figures. The advancing district was the Central Northwest territory, comprised of Minnesota, the Dakotas, the Northern peninsula of Michigan, and Northwest Wisconsin. Its total of $6,900,600, comparing with $4,851,000 in November, 1930, showed gains in all three major construction groups.

Total construction contracts awarded in November in the entire 37 states east of the Rockies amounted to $151,195,900. This was divided among the three major classes with $45,290,400 in residential building; $58,495,800 in non-residential building and $47,409,700 in public works and utilities. The loss from October when large contracts for Radio City swelled the total amounted to 38 per cent. as contrasted with a customary seasonal decline of less than 15 per cent.

Residential contracts awarded during November showed a loss in dollar volume of 25 per cent. as contrasted with October; the decline from November, 1930, amounted to 44 per cent. Non-residential building contracts awarded in November declined 41 per cent. from October and 39 per cent. from November of last year.

Public buildings were alone in the non-residential group to advance during November and also for the eleven elapsed months of the year for which a gain of 39 per cent. was shown as compared with the corresponding period of 1930. The decline in commercial buildings was 49 per cent. while factories showed a loss of 53 per cent.

Residential gains over November, 1930, were scored during the month just ended in New England and the Central Northwest. Non-residential building advances were made in the Metropolitan area of New York, Middle Atlantic, Southeastern, and Central Northwest districts. Increases in public works and utilities were registered in the New England, Upstate New York, Central Northwest, and Southern Michigan territories.

The five territories showing the largest totals during November were Metropolitan New York with $33,000,300; New England with $17,104,200; Middle Atlantic with $21,431,500; Pittsburgh district with $15,610,000; and the Chicago district with $13,640,700.

Superior Portland Gets 45,000-Barrel Contract

A contract to supply approximately 45,000 bbl. of cement has been awarded to Superior Portland Cement, Inc., of Concrete, Wash., by the United States Reclamation Service. The cement is to be used in the construction of the CleElum Irrigation Dam near Roslyn, Wash.

The initial shipment on the order was made about December 1. This important contract, in addition to normal winter sales, will keep the Superior plant in operation throughout the winter, it is believed.

100 Men Start Work at Northwest Magnesite Co.

Approximately 100 men resumed work early this month at the plant of the Northwest Magnesite Co. at Chewelah, Wash., according to J. C. Hutchinson, manager of operations.

Sufficient orders are now on hand to assure almost capacity operation until spring.

Fire Damages Company's Laboratory and Offices

Fire caused considerable damage early in December when it swept the Broadway Bldg. in Albany, N. Y. The Albany Sand & Supply Co., whose offices and laboratory were located in the building was one of the chief sufferers.

Record Stone Order

The largest single order ever booked, involving 1,600,000 cu. ft. of undressed limestone for use in building the new Rockefeller Radio City project in New York, has been received by the Indiana Limestone Co. of Bloomington, Ind. This contract alone will be sufficient to keep the quarries working three years at capacity, officials have announced.

Unfilled Orders for Cement Reported Up

IOWA CONCERN HOLDS MEETING

A satisfactory year in sales and shipments and a larger number of unfilled orders than a year ago was the report made by officers at the annual meeting of the Northwestern States Portland Cement Co. held at Des Moines, Ia., early this month.

Col. Hanford MacNider, United States minister to Canada, was re-elected president and general manager of the company, while Frank J. Hanlon, formerly director, was elected vice-president, succeeding A. F. Frudden of Hollywood. Willis G. C. Bagley was re-elected treasurer.

A new member was added to the board of directors in the person of William Stern, cashier of the Dakota National bank of Fargo, former national vice-commander of the American Legion.

Other directors, all of whom were re-elected, are: E. C. Frudden, Dubuque; M. T. Gunderson, Kenyon, Minn.; S. T. McKnight, Minneapolis; Edwin White, St. Paul; S. L. Wright, Winona, Minn.; William Chamberlain, Chicago, and Fred Keeler, Los Angeles.

B. A. McDonald was again chosen assistant to the president and assistant general manager; Peter Anderson, secretary, and Clarence A. Hanson, assistant secretary.

Colonel MacNider stated there was every expectancy that the plant would continue operating through the winter months on a schedule as heavy as orders on the books and capacity will allow.

Marquette Cement Starts Installing New Coolers

Marquette Cement Manufacturing Co. has started work on the enlargement of its plants at Cape Girardeau, Mo., and La Salle, Ill., involving an expenditure of $500,000 and the employment of 250 men.

The program includes the installation of 15 new type clinker coolers. Theodore G. Dickinson, president of the company, states a number of large orders have been received recently, while a renewal of a government contract calls for 6,000 bbl. of cement a day.

Long Island Operator Adds Floating Units

CAN LOAD 1,000 TONS AN HOUR

The Goodwin-Gallagher Sand & Gravel Corp., already one of the largest producers of sand and gravel in the New York area, recently expanded its operations on Long Island. Unlike the company's main plant at Port Washington this operation consists entirely of floating equipment. It is a self-contained unit and is a distinct and additional source of gravel from the shore plants.

Early in the spring of 1931 this company took over the centrifugal dredge *Trojan* and the screen boat *Liberty*, formerly operated by the Warner Co. at Philadelphia. Due to legal difficulties regarding the right of the company to dredge gravel on Long Island the boats were not put into operation until the middle of November. Operations are being carried on near Northport, L. I., where the company has 175 acres of gravel, enough for from 7 to 10 years' operation according to J. J. Gallagher, president and general manager of the company.

The dredge *Trojan* is a modern all-steel dredge with a 20-in. dredge pump. It was brought in first to dig out a pond large enough for both boats. The *Liberty* was originally a ladder dredge with sizing equipment on deck but is now being used entirely for sizing the material pumped from the *Trojan*. Four sizes of material are produced—sand, pea gravel, regular gravel and cobbles. Four barges are loaded at one time, two on each side, and the capacity of the operation is 1,000 tons per hour.

Changes are now being made to the screens so that the product will conform to New York state specifications. The loading chutes are also being rebuilt to allow for the width of the barges being used which are wider than the barges used in Philadelphia.

New Hudson River Plant to Be Opened in Spring

Operations are to continue throughout the winter at the new plant and quarry of the Hudson River Stone Corp. at Mt. Taurus, N. Y., according to James Slattery, in charge of construction for the company. The contractors are required to have the plant in readiness for operation in the spring, since the Hudson River Stone Corp. holds contracts for the delivery of crushed stone in April, it is reported.

Work is now under way on the storage silos, and the erection of the crushing plant will be pushed during the winter. The work of constructing a loading dock out into the river is well advanced at the present time.

Approximately 120 men are employed on the operations at Mt. Taurus, Mr. Slattery said.

The floating plant loading to barges.

Producer at Pittsburgh to Build Crushing Plant

Several years ago the Iron City Sand & Gravel Co., Pittsburgh, Pa., installed crushers on two of its three river dredges to utilize large material which had formerly gone to waste These were taken out in the spring of 1931 and crushing was done instead at the shore plant at 22nd and Wharton streets on the Monongahela River, a temporary unit being employed. Now a new crushing plant will be erected during the winter at this location which will be similar to the unit at the New Martinsville, W. Va., plant of the Ohio River Sand & Gravel Co. which went into operation early in the summer. This improvement is being made to provide crushed gravel for certain types of road work in which crushed stone had formerly been used exclusively.

Inland Lime & Stone Co. to Operate This Winter

Although the navigation season on the Great Lakes has closed for the winter, the crushed-stone plant of the Inland Lime & Stone Co. at Port Inland, near Manistique, Mich., will continue to operate throughout the cold weather, building up reserves for shipment next spring. This announcement was made recently by A. J. Cayia, superintendent, who declared that about 125 men would be employed. Most of the stone produced at Port Inland is used for fluxing purposes at the plant of the Inland Steel Co., the parent concern, located at Indiana Harbor, Ind.

New Pacific Coast Sand-and-Gravel Plant Opens

The new $75,000 plant on the Russian River, near Healdsburg, Cal., of the Basalt Rock Co. of Napa, Cal., was placed in operation for the first time on December 4.

The plant has daily a capacity of 150 tons of sand and gravel which is dredged from the bed of the Russian River.

The new plant was constructed after the company had purchased the Russian River Gravel Co., a competitor. The improvements were directly supervised by Albert Streblow, president of the Napa concern.

The manager of the Healdsburg plant is Follett Morris, son of Harry Morris, of Napa, one of the founders of the Basalt Rock Co. Lloyd Smeed, formerly with the Russian River Gravel Co., will be superintendent.

Installs Rock-Phosphate Grinding Plant in Idaho

The Phosphate Fertilizer Co. of Spokane, Wash., is installing a mill for grinding 100 tons of rock phosphate a day at Georgetown in the most southeasterly county in Idaho. W. H. Honefinger of Spokane is manager of the company and Oscar F. Nordquist of Wallace is in charge of the operations. The company will also erect a plant at Los Angeles for fine grinding in the near future and expects to find a good market for its product in southern California and abroad.

Two Cement Mills Go 5 Years Without Accident

The Alpha Portland Cement Co. plant at Ironton, O., completed its fifth year without a loss-time accident on December 8, 1931, it was announced recently by F. C. Brownstead, superintendent. The committee which has worked diligently in making this record possible is composed of W. L. Patterson, chairman; William Butler, Walter Carmen, J. S. Beddall, John Dole, Oscar Tayler, Henry Hafle, A. C. Manis, J. B. Hall, A. McCarley, C. E. Whitlatch, A. A. Madden and W. A. Brooks.

The record which has been achieved by the Ironton plant ranks them second in the Portland Cement Assn., rating the Lehigh Portland Cement Co. plant of Iola, Kan., being first by a few months. The association is considering some special recognition for these plants, in addition to the regular safety trophy.

Urges Buyer Specify Cement Made in U. S.

IMPORTERS HAVE OTHER IDEAS

"I see no reason why the American builder should not be made fully aware of the situation that cement and perhaps other building material manufacturers serving the Atlantic Coast markets are beginning to confront," declared Frank H. Smith, president of the Lawrence Portland Cement Co. and chairman of the board of the Portland Cement Assn. in a recent interview in a New York newspaper.

"Once before we had to face it and so long as England stayed on the gold standard we were able to hold our own competitively on this side of the ocean. With tariff help we were able to protect our American workingmen in their jobs.

"After the close of the war the foreign cement manufacturers, at that time principally Belgian, found themselves with no market over there for their products and they turned to this country to find one. Cement for the first time in history began to come to these shores in really serious competitive quantities and the defense of the American manufacturer at that time was in the form of a successful appeal to the patriotic American owner, builder and architect to specify American-made materials so that our national prosperity, into which we were destined at that time to enter, might proceed.

"Congress helped the building industry a little, but really not enough to wholly safeguard the manufacturers doing business in the Atlantic Coast line markets, as shown by the fact that prices of American-made cement gradually fell to within hailing distance at least of that asked for the foreign-made product and there the situation has since stayed, off and on.

"Now a new situation has arisen. England's departure from the gold standard, however temporary, literally forced the quick marketing of quantities of cement, and no doubt huge quantities of other materials. Since ours is the only comparatively high-priced market in the world, their cement is coming over, in spite of our already lowering prices, and so a new problem pends.

"As I said, the other crisis was mostly met by an appeal to patriotic American contractors and American owners and American architects and engineers to buy, specify and use American-made building materials.

"Ten years ago the appeal was based upon helping the soldier-Americans to get back into their jobs in American industry. Today the call is far more appealing. Not only are many of those former doughboys out of work, but some four million of their fellow-countrymen and their dependents are in distress.

"Everybody wants to see them headed toward prosperity once more, but that happy eventuality will have to be still further deferred unless those who build, however small their need for structural supplies may be, insist upon buying, specifying and using American-made materials."

Importers, however, are inclined to regard the situation more lightly. Capt. Maurice G. Roux, president of the International Non-Staining Cement Company, importers of La Farge Non-Staining and other cements from France said:

"Because of fears that with the lowering of the gold value of the British pound some British Portland cement may find its way into some of the ports of the United States, Mr. Smith sends a supplication to American architects and builders to favor American cement against foreign cement and other building materials.

"Two years ago we were also told that if a duty was passed on Portland cement, Belgian cement would be kept out and everything would be fine again. For over a year now, no Belgian cement has been used on the buildings of New York and yet the actual situation of the Portland cement industry in the New York district cannot exactly be taken for a model of good organization conducive to prosperity.

"Even if the advice of Mr. Smith was scrupulously followed, I very much doubt that this would be the solution that would end the building slump, which is just as bad inland, where no foreign material can go, as on the shoreline."

E. R. Hollander, president of the Ferrocrete Cement Co., Inc., importers of cement of that name manufactured in England, said:

"I doubt if this patriotism appeal has often been referred to during the last few decades by our American makers of typewriters, sewing machines, automobiles and numerous other manufactured articles which have always found a large and generous market in Great Britain, and to an amount nearly 100 times greater in value than that represented by the relatively insignificant quantities of cement imported from that country into the U. S. A.

"I can state positively that at the present time Great Britain is not overproduced in cement. As a matter of fact, there has been more of the product sold in the British Isles than ever before. The British are not seeking a market in this country for dumping material due to their inability to absorb it at home. They are merely shipping in normal quantities into a market in which they have been active with their products for the last eight years."

Contract for the paving of two miles of concrete road near Unionville, Mich., has been awarded the Hersey Gravel Co. of Hersey, Mich.

Convert Three Ships Into Self-Unloaders

WILL TRANSPORT LIMESTONE

Three steamers, the *William T. Roberts*, the *Theodore H. Wickwire, Jr.*, and the *Louis R. Davidson*, each of approximately 10,000 tons capacity, are to be converted into self-unloading vessels during the winter by the Thunder Bay Quarries Co. of Alpena, Mich. The vessels will be rebuilt at the Lorain, O., shipyards of the American Shipbuilding Co. and, according to W. H. Gerhauser, president of the shipbuilding concern, about 1,000 men will be employed in rebuilding them.

The boats will be used next season to transport limestone from the new plant of the Thunder Bay Quarries Co. at Alpena to the Fairport, O., docks of the Diamond Alkali Co. Much of the stone will be utilized in the manufacture of cement at the plant of the Standard Portland Cement Co., a subsidiary located but a short distance from Fairport harbor, at Painesville, O.

Electrically-driven belt conveyors supplied by the Robins Conveying Belt Co. will be employed in the conversion of the ships to self-unloaders.

When the vessels are rebuilt and placed in service they will be rechristened as the *Diamond Alkali*, the *Standard Cement* and *Thunder Bay Quarries*.

Extensive Rock-Asphalt Deposit in New Mexico

A rock-asphalt deposit near Santa Rosa, N. M., is being developed by the New Mexico Construction Co., under the supervision of Vincent K. Jones. Drill holes in the deposit indicate it is of an extensive nature and the first material removed and processed has been used in paving several blocks of Santa Rosa's streets. A study of the deposit has been made by the Bureau of Mines and Mineral Resources of the New Mexico School of Mines, Socorro, N. M., according to T. P. Wootton, statistician.

Ahearn, Sanborn Talk at Indiana Highways Meet

The trend of the market in the construction industry was discussed at the eighth annual meeting of the Indiana Highway Constructors, Inc., at Indianapolis, Ind., early in December. Speakers on the program, included V. P. Ahearn, executive secretary of the National Sand & Gravel Assn., Washington, D. C.; W. R. Sanborn, vice-president of the National Crushed Stone Assn., of Kankakee, Ill.; O. W. Irwin of the Concrete Reinforcing Steel Institute of Youngstown, O.; and C. R. Messenger of the Chain Belt Co., of Milwaukee, Wis. Arrangements for the meeting were in charge of William Holland of Indianapolis, secretary.

Road Builders Ready for 1932 Convention

MEET AT DETROIT, JAN. 10-15

Arrangements are now complete for the 29th annual convention and exposition of the American Road Builders' Assn., to be held January 10 to 15 at Detroit, Mich. All sessions of the gathering as well as the show will be in the Detroit Municipal Airport Bldg., with the social affairs at the Book-Cadillac Hotel. The program will be as follows:

Sunday, January 10.

4:00 p. m.—Reception and Tea honoring delegates from Canada. Book-Cadillac Hotel.

Monday, January 11.

9:00 a. m.—Exposition opens.
2:00 p. m.—Report of Committee on Highway Location — Recent Developments in Surveying Methods and Equipment.
2:00 p. m.—Report of Committee on Administrative and Financial Relationship of State and County.
2:00 p. m.—Report of Committee on Bins, Batchers and Equipment for Handling and Weighing Bulk Cement.
2:00 p. m.—Report of City Committee on Pavement Finance.
4:30 p. m.—Meeting, Pan-American Delegates.
6:00 p. m.—County-Highway Officials' Dinner.
6:00 p. m.—City-Officials' Dinner.
8:15 p. m.—"Highway Programs and Prosperity."

Tuesday, January 12.

10:00 a. m.—Motor Freight Session.
10:00 a. m.—Combined Session on Plain and Reinforced Concrete Highways.
10:00 a. m.—Report of County Committee on Legislation, Administration and Finance.
10:00 a. m.—Report of City Committee on Design and Construction.
2:00 p. m.—Motor Freight Session.
2:00 p. m.—Combined Session on Maintenance, Construction and Equipment for Low Cost Roads and Bituminous Surfaces.
2:00 p. m.—County Highway Officials' Session.
2:00 p. m.—Report of City Committee on Maintenance.

Wednesday, January 13.

10:00 a. m.—Report of Committee on Recent Practical Developments in Design and Construction of Brick Pavements.
10:00 a. m.—Report of Committee on Central- and Truck-Mixed Concrete.
10:00 a. m.—Combined Session on City Traffic and Traffic Devices and Their Application.
2:00 p. m.—Report of County Committee on Design and Construction and County Committee on Maintenance.
2:00 p. m.—Report of City Committee on Airports.
2:00 p. m.—Pan-American Session.
2:00 p. m.—Highway Contractors' Session.
7:30 p. m.—Road-Builders' Banquet.

Thursday, January 14.

10:00 a. m.—Meeting, Association of Asphalt Paving Technologists.
10:00 a. m.—Recent Practical Developments in Design and Construction of Low Cost Bridges.
10:00 a. m.—Session on Grading Methods.
10:00 a. m.—City Officials' Session.
2:00 p. m.—Combined Session on Equipment.
2:00 p. m.—Meeting, Association of Asphalt Paving Technologists.
2:00 p. m.—Business Meeting, County Highway Officials' Division.
2:30 p. m.—Business Meeting, Manufacturers' Division.
4:30 p. m.—Business Meeting, American Road Builders' Assn.
9:00 p. m.—International Ball.

Friday, January 15.

9:00 a. m.—Exposition open to delegates and visitors until 4:00 p. m.

BUILDING-MATERIAL PRICES, NOVEMBER 1, 1931

Data collected by the Bureau of the Census and prepared by the Division of Building and Housing, U. S. Bureau of Standards.

City	Portland Cement (*bbl.*)	Gypsum Plaster (*ton*)	Gypsum Plaster Board (*1,000 sq. ft.*)	Hydrated Lime (*ton*)	Building Sand (*cu. yd.*)	Crushed Stone (*ton*)	Roofing Slate (*100 sq. ft.*)
Akron, O.	$1.74	$14.00	$.....	$12.00	$1.50	$2.50	$12.00
Albany, N. Y.	2.34	16.20	23.85	15.75	.....	.....	.....
Atlanta, Ga.	2.50	19.50	.....	.....	2.81	2.50	.....
Baltimore, Md.	2.20	15.50	25.00	13.00	1.85	2.50	10.00
Buffalo, N. Y.	2.95	16.00	21.00	18.00	2.50	2.05	12.00
Canton, O.	.....	.....	.....	16.00	2.50	.....	.....
Chicago, Ill.	1.25	13.00	25.00	12.50	1.75	1.25	.....
Cincinnati, O.	1.94	.....	22.75	14.40	2.63	2.55	.....
Cleveland, O.	1 68	16.00	.....	10.00	1.69	2.15	16.00
Columbia, S. C.	2.25	15.40	35.00	12.50	1.08	2.25	13.00
Columbus, O	2.35	14.40	.....	12.00	1.50	2.75	14.00
Des Moines, Iowa	1.42	14.00	23.50	19.00	1.40	4.15	15.00
Detroit, Mich.	2.00	15.00	25.00	12.00	2.03	1.75	.....
Erie, Pa.	2.00	16.00	22.50	16.00	2.00	.....	.....
Fairmont, W. Va.	2.80	18.00	35.00	16.00	2.80	3.50	13.00
Grand Forks, N. D.	2.60	19.00	.....	.....	2.60	.....	.....
Haverhill, Mass.	2.32	18.50	25.00	18.00	.....	.....	.....
Kansas City, Mo.	1.68	15.00	25.00	.....	1.60	1.88	16.00
Lansing, Mich.	2.25	.....	.....	20.00	1.80	1.80	.....
Louisville, Ky.	1.86	17.00	.....	15.00	2.00	2.15	.....
Milwaukee, Wis.	1.25	15.20	22.00	.....	1.25	1.25	.....
New Bedford, Mass.	2.40	16.50	24.00	16.50	1.75	2.75	.....
New Haven, Conn.	2.40	.....	.....	15.00	1.50	2.00	.....
New London, Conn.	2.60	18.00	25.00	18.00	1.50	3.00	.....
New Orleans, La.	2.35	18.00	.....	.....	1.85	.....	11.00
Paterson, N. J.	2.00	17.50	24.00	18 00	1.50	2.10	12.00
Philadelphia, Pa.	2.10	17.50	.....	14.50	1.75	2.60	11.22
Poughkeepsie, N. Y.	1.95	13.00	.....	26.00	2.25	2.20	.....
Richmond, Va.	3.10	20.00	31.00	17.50	1.95	2.45	13.00
Rochester, N. Y.	2.28	16.00	22.00	20.00	2.25	2.40	12.00
St. Louis, Mo.	....	18.00	.....	18.00	1.35	1.30	13.00
St. Paul, Minn.	2.15	17.00	21.00	19.00	1.25	1.75	11.50
Saginaw, Mich.	1.80	18.00	25.00	16.50	2.25	2.20	14.00
San Antonio, Tex.	2.43	17.00	42.00	20.00	2.25	2.35	16.50
San Francisco, Cal.	....	16.90	45.00	22.50	1.40	1.60	.....
Scranton, Pa.	2.40	19.00	.....	20.00	3.25	.....	.....
Shreveport, La.	3.00	20.00	.....	.....	2.00	3.20	.....
Sioux Falls, Ia.	2.00	15.00	40.00	22.00	1.25	2.25	.....
Syracuse, N. Y.	2.16	15.00	25.00	13.00	1.80	1.70	13.50
Tampa, Fla.	2.60	.....	.....	24.00	2.00	3.50	.....
Terre Haute, Ind.	2.25	18.00	28.00	18.00	1.25	3.00	13.25
Toledo, O.	1.40	14.00	21.00	14.00	1.60	1.75	.....
Trenton, N. J.	2.20	18.00	20.00	18.00	1.50	2.15	9.75
Tucson, Ariz.	3.25	17.10	45.00	30.00	1.25	2.25	.....
Tulsa, Okla.	1.90	16.00	22.50	22.00	.85	2.36	.....
Washington, D. C.	1.65	16.00	25.00	12.00	.....	.....	.....
Waterbury, Conn.	2.60	20.00	30.00	20.00	1.25	2.45	15.00
Wichita, Kan.	1.60	15.00	23.00	22.50	1.00	.....	.....
Youngstown, Ohio	2.43	18.00	23.25	16.00	2.50	2.50	14.00

Fire Wrecks California Sand-and-Gravel Plant

The sand-and-gravel plant on Dry Creek between Chico and Oroville, Cal., owned by Edwin E. Meyers of Chico was destroyed by fire of uncertain origin recently.

The plant was being overhauled preparatory to starting operations on a large scale. While fighting the fire E. R. Crawford, an employe, was overcome by smoke.

Cement Plant Celebrates Three-Yr. Safety Record

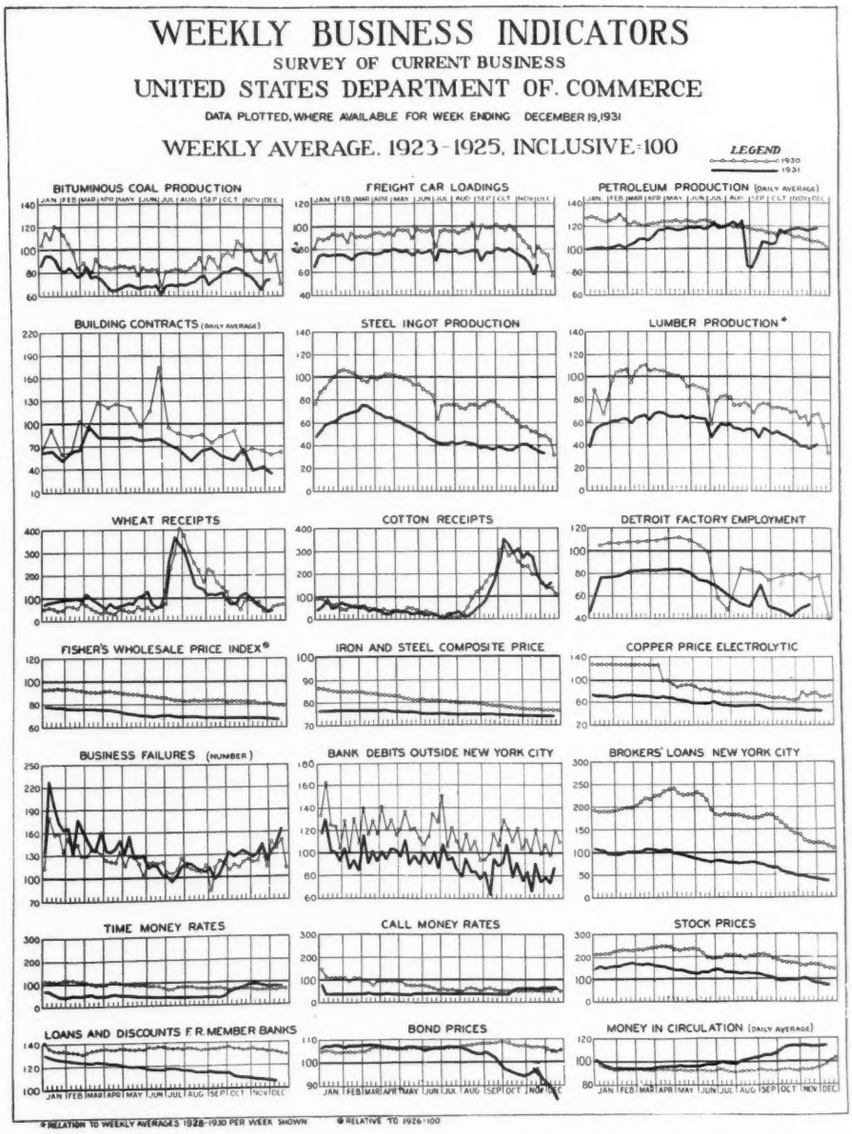
Employees and officials of the Marquette Cement Manufacturing Co., celebrated the completion of three years at the Cape Girardeau, Mo., plant without a single lost-time accident on November 24. The celebration, attended by approximately 500 persons, was also the occasion for presentation of the bronze trophy given in recognition of the record by the National Crushed Stone Assn. and the *Explosives Engineer*.

Presentation of the trophy was made by W. R. Sanborn, Kankakee, Ill., vice-president of the National Crushed Stone Assn., and was accepted by E. M. Gould, quarry superintendent at the Cape Girardeau plant.

M. P. Greer, safety engineer at the plant, explained the safety record established by the plant. In the cement mill the employees worked for three years and two months without a lost-time accident, and in the quarry a four-year record will be established this year. At the time of the celebration this department had 1430 days without accident having been charged to it.

Gravel Co. Reorganized; Detroit Man President

The Michigan Concrete & Materials Co., which erected a new plant at Centerville, Mich., early this year and was forced into receivership shortly thereafter, has been reorganized under the name of The Centerville Gravel Co. C. C. Alford, one of the stockholders in the old company, was instrumental in reorganizing the concern and is its new president. Mr. Alford was formerly in the aggregates-producing business at Detroit.



Hat Island Producer to Build Puget Sound Plant

Development of sand-and-gravel deposits on Puget Sound has been started on an extensive scale by the Hat Island Sand & Gravel Co. Approximately $75,000 will be expended in erecting a plant, according to Alex Thompson of Seattle, one of the officials of the company. Other members of the firm are Richard Effendahl and George Carey, both of Seattle.

Form Society to Combat Industry's Dust Hazards

Representatives of producer and consumer organizations in the nonmetallic-mineral industries recently formed the Industrial Safety Society, the prime motive of which is to seek to combat silicosis and other dust hazards among workmen. Robert A. Bautz, nonmetallic-minerals engineer, with offices at 236 N. Clark St., Chicago, has been made secretary.

The society plans a thorough exchange of ideas on the subject and hopes ultimately to bring about, through united effort, a general revision of workmen's compensation laws in the various states. It is generally felt that the present statutes are inadequate and equitable to neither employer nor employee.

The members of the society will also assist each other in fighting unjust claims of employees for injury to health due to dust inhalation. Such claims, according to Mr. Bautz, have assumed the proportions of a "racket" during recent months.

Indiana Architects Hear Address by Walter Hart

Walter E. Hart, manager, Structural and Technical Bureau, Portland Cement Assn., was one of the principal speakers at the Indiana architects' conference on building construction held at Purdue University, Lafayette, Ind., December 14 and 15. Mr. Hart's subject was "Monoliths in Concrete," in which he described the recent advancements made in the use of monolithic concrete as the medium for the architectural expression of exteriors.

Twelve Makers Share in Indiana Contracts

BUYS CEMENT FOR 1932 ROADS

Contracts for 237,000 bbl. of cement were awarded to twelve bidders by the Indiana highway commission on December 3. Prices ranged from $1.16 to $1.28 a bbl. to the point nearest the destination of construction work. The cement will be used on 1932 projects of the highway commission.

The Indiana commission remains undecided as to whether it will change the system of cement bidding, by awarding projects to the contractor with the provision the contractors would provide the cement rather than the state buy it, it was said at the Statehouse. The commission also announced it would receive bids on 2,000,000 bbl. of cement late in December, the contracts providing that the state could reject all bids.

The bids were awarded following a conference of the highway commission with Governor Harry G. Leslie.

Contracts were awarded the following companies: Alpha Portland Cement Co., 5,000 bbl.; Consolidated Cement Co., 10,000 bbl.; Kosmos Cement Corp., 5,000 bbl.; Lehigh Portland Cement Co., 33,000 bbl.; Lone Star Cement Co., Indiana, 33,000 bbl.; Louisville Cement Co., 33,000 bbl.; Marquette Cement Mfg. Co., 10,000 bbl.; Medusa Portland Cement Co., 15,000 bbl.; Pittsburgh Plate Glass Co., 12,000 bbl.; Southwestern Portland Cement Co., 15,000 bbl.; Universal-Atlas Cement Co., 33,000 bbl. and the Wabash Portland Cement Co , 33,000 bbl.

Fluxing-Stone Operator to Produce Road Stone

Erection of a crushed-stone plant for the preparation of road-building materials is soon to be started at Gadsden, Ala., by C. A. East, who now operates a quarry and plant for the production of fluxing stone on this location. Upwards of $10,000 worth of equipment has already been contracted for, according to East and additional spur trackage is to be laid this winter by the Louisville and Nashville Railroad.

Notla Talc Co., Enlarges Plant near Murphy, N. C.

The Notla Talc Co., located six miles west of Murphy, N. C., is enlarging its plant. The company is prospecting its property by diamond-drilling, and has found additional deposits of high-grade talc.

Business has been on the increase for the past three months, according to the manager, J. W. Bailey. The Notla Talc Co. is owned by the Binney & Smith Co., New York, N. Y.

Editorials

A Good Time for Mergers

THE man in the street looks upon a merger as some perversion of business economy by which he sees the producer strengthened and the consumer weakened. The state of mind which produced our anti-trust laws has not yet been altered to that more intelligent state which can see in the amalgamation of producing units a betterment in production processes and a betterment in product or a reduction in price. Some producers, fearful of their competitors and any action which may tend to strengthen them, oppose mergers in their own industries when, in many cases, they might themselves benefit from them, either directly by becoming parties to them or indirectly by the resulting reduction in the number of competitors. In industries which are overcrowded—and our own field affords striking examples of the disastrous effects of overcrowding and its inevitable result, overexpansion and overproduction—mergers may have a most wholesome effect by softening competition, checking production, and stabilizing prices.

Certainly there must be many producers who are thinking seriously of possible mergers involving themselves or their competitors. As prices continue to fall under the ruthless price-cutting tactics of some producers, every one, even the vicious price-cutters themselves, must long for relief from a situation which destroys profits and, in so doing, imperils business itself. In many cases mergers will provide the solution, if they are sufficiently far-reaching and if they are followed by the adoption of sounder business practices than those which make such mergers desirable. If a merger accomplishes nothing more than a transfer of ownership, and fails to bring about policies that will improve the practices followed by its constituents, whether these continue to operate under their individual identities or as a single unit, it performs no useful service to the industry of which it forms a part or to the public which it supplies.

One of the great advantages of a merger is the power of fixing prices and regulating production, functions which it can perform legally acting as a single unit but which its predecessors could not lawfully practice by agreement. Furthermore, wholly aside from the legal aspects of the question, this form of price and production regulation can be accomplished because the authority resides in a single management, whereas under the separate managements that precede it verbal agreement may be possible in spite of its illegality, but can not be enforced because of its illegality.

Very little will be gained by mergers in our industries—even in the cement branch where they are, perhaps, most needed—unless production is curtailed chiefly by the abandonment of obsolete or nearly-obsolete plants so that production can be concentrated in the plants that remain. Nor will there be any material gain if the abandoned plants are to be replaced by new ones, erected either by the merged producers or by their competitors. As many of the obsolete plants, particularly in the cement industry, have repaid in profits the cost of their erection and improvement, those who absorb them in any projected merger should not hesitate to scrap them, especially if, as should be the case, they are appraised at their true worth when compared with modern plants.

At this time, when obsolete plants can not profitably be modernized even if the economic justification for such improvement could be shown, mergers promise to accomplish more for industrial stabilization than at any former time, and this fact is recognized by many important producers. Holgar Struckmann expressed the same view when, on returning recently to this country, he said that "it is my opinion that, as a result of the current depression, the cement industry will witness consolidations of the stronger units and the elimination of the weaker ones. This is necessary to bring about greater economy in production and distribution." To which he might have added with equal truth that it is also needed in order to strengthen prices and raise them to profitable levels.

False Standards and Poor Business

ONE of the most potent of the many influences delaying business recovery is the inability of most people to form sound opinions. In spite of our unparalleled facilities for providing education and of our unusual means for spreading information, we are badly equipped for learning the truth, for recognizing it when we see it, and for applying it when we recognize it. We pick up and assimilate misinformation much more readily than we acquire facts, largely because we have more experience with the one than with the other.

The information on which we base our opinions of the state of business is typical of the scanty data that are given us on subjects of great importance. It is characterized by the same unreliability, the same paucity of detail, the same taint of propaganda, that mark all the news we get. In all our information there is, of course, an element of truth, the same kind of truth and the same degree of truth that one finds in common gossip. It is never enough for the formation of reasoned judgment or for the justification of definite action. Yet it is the groundwork on which we work and build, so there should be little wonder if we often work at cross purposes and build unwisely.

Records of the stock-market, car-loadings, bank clearings, commodity prices, gold movements, foreign trade, real-estate transfers, chain-store sales—the list could be extended to fill this page—are watched with eagle-like attention by millions of people who believe, through blind faith, that these are barometers of business, that they can be

relied upon, not only to show how business has been but to forecast how it will be.

Up and down goes the stock-market, and up and down goes the pulse-rate, the confidence-factor, of a whole people. Yet the stock-market is about as reliable an index to business conditions as a fever thermometer, alternately heated and cooled by playful children, would be to a man's health.

Car-loadings of one year are compared with those of its predecessor and, if the tendency be downward, business pulls a long face and draws back. Yet we ship hundreds of millions of tons of merchandise by motor truck, and each year the tonnage increases in relation to that moved by the railroads, but there is no record anywhere of this huge movement of commodities. Car-loadings show part of the truth—and no one knows what part of the truth—yet business plans are often predicated on their weekly, monthly, and yearly fluctuations.

A similar reverence is shown for the record of bank clearings, although no allowance is or can be made for the extent to which these are affected by slow collections, cash purchasing, and the like. Because they may appear to be reliable indices at times, ergo they must be dependable always.

Of what significance are prices, when these are determined more often by the extremity or whim of the individual seller than by any general situation of which he is truly aware? If A elects to undersell B, must business therefore remain at a standstill? And if B, not to be outdone, decides to retaliate by underselling A as well as himself, must commerce be paralyzed? If a few men lose all sense of proportion, must the world go mad?

There are thousands of men who pretend to see accurate warnings in the changing record of gold movements, although just how much comfort they will derive from this subject now that the gold standard is out of fashion in so many erstwhile gold-worshipping countries, remains to be seen. They fail to recognize here a carry-over of our forefathers' reverence for gold as a measure of wealth.

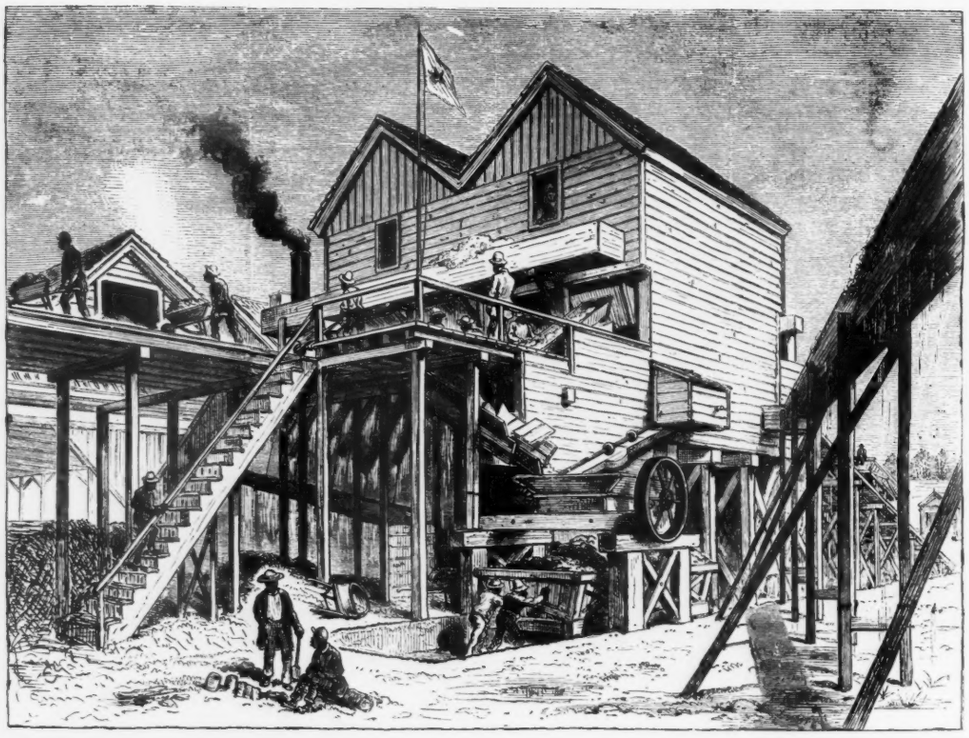
The same men who will argue the value of foreign trade as a guide to the state of business will contend for high tariff or free trade—depending on the relation of their own businesses to exports and imports—and yet it should be obvious to them that there can not be two opposite causes resulting in the same effect. If imports increase, up should go the tariff, says one; if imports decline, it is high time for free trade, says the other. Each one hopes for what is called a "favorable trade balance," failing to realize that what is favorable for one country is unfavorable for another, and that the country which suffers from an unfavorable balance becomes an increasingly poor customer and so tends to reverse the flow of foreign trade.

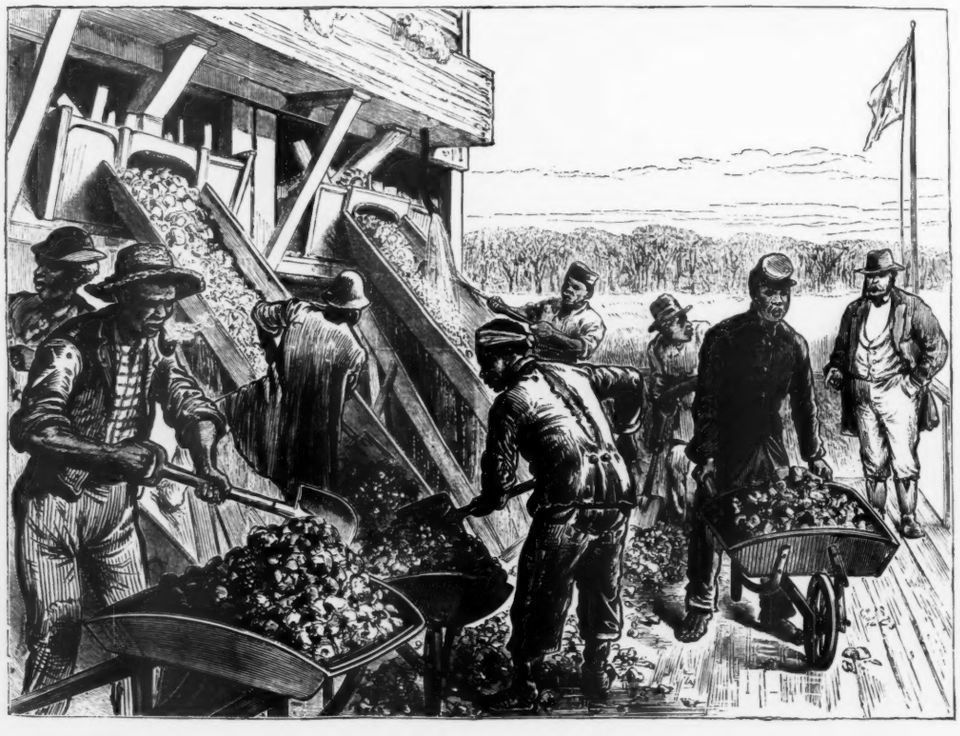
Chain-store sales are another fetish which appears to supply a useful guide but which, in reality, is fully as misleading as any of the others. To the total sales of all commodities these stand in about the same relation as car-loadings to the total movement of commodities. The scores of thousands of independent merchants, ranging from the metropolitan department store down to the village store-keeper, are ignored by the man who relies on chain-store data, and he makes no allowance for the fact that public dependence on chain-stores is increasing and, as business declines, increases at a still more rapid rate.

Those who earnestly try to find some infallible guide to business conditions realize the insufficiency of each one of the hundred-odd "keys" that are used by different men in arriving at what they call "sound" conclusions, and a few of them have been tempted to combine certain ones of these "guides" in the hope of finding a combination that would not be open to the criticisms that lie against them individually. But those of them who are honest have admitted their discovery that no combination of fallacious factors can be any more dependable than any of those factors individually and that they only complicate the situation and add to their own confusion when they try to juggle their data or to invent some combination which, while adding new factors of undependability, is expected to clarify and cancel out the unreliability of its constituents.

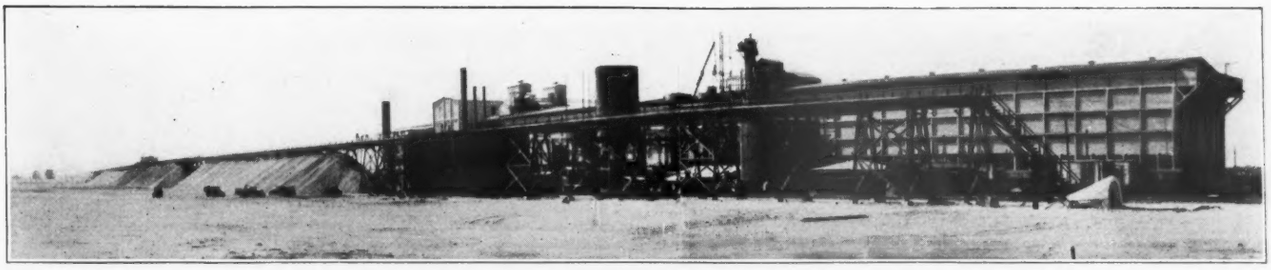
The so-called "economists" who write or edit those alternately encouraging and depressing "surveys of business" which issue each month from our more opulent banking institutions are largely responsible for the slavish worship of meaningless statistics which characterizes the modern business man, who, having at last clutched at what he believes is bed-rock, has merely laid aside one form of uncertainty in order to pick up another. In our opinion he has made a poor exchange. While the uncertainty he laid aside was based on ignorance, it was an ignorance that was frankly admitted; while the pseudo-certainty which he has grasped in its stead, is that cocksureness that is based on an ignorance which, while it is still nothing more than ignorance, wears the trappings of knowledge, definiteness, and certainty.

There are few things that we know for certain—the inevitability of death, the necessity for sustenance to support life, the need for labor to provide sustenance, and so on—the rest is still in the realm of opinion. Our knowledge increases as we discard our fetishes, as we rely more and more on what can be appraised by physical standards and as we become more and more skilled in the interpretation and evaluation of the results of such appraisals. The present state of business exists largely because men have been guided by false standards, because these have been passed along from mouth to mouth without having been given the slightest critical examination, without having been weighed by the most ordinary standards of credibility. And the present state of business continues because men have not yet learned their mistake, because they have not yet learned which facts are pertinent and which impertinent, and because they have not yet learned properly to appraise, properly to discriminate between, those which have a bearing on the subject being studied. Business will recover when the public mind has freed itself from the inertia and despair which becloud it, and the rejection of false standards of evaluating business is the first step in that direction.





THE above pictures were reproduced from wood-cuts appearing in "Frank Leslie's Illustrated Newspaper" of June 30, 1877 and illustrate scenes typical of the production of phosphate rock at Charleston, S. C., at that time. Note the large amount of manual labor in proportion to the small amount of rock handled.



New trestle for stock-piling and drying plant of International Agricultural Chemical Co.

Progress in Phosphate-Rock Industry Is Reflected in New Florida Plant

Drying-and-Pulverizing Unit on 43,000-Acre Tract Has Yearly Capacity of 1,500,000 Tons

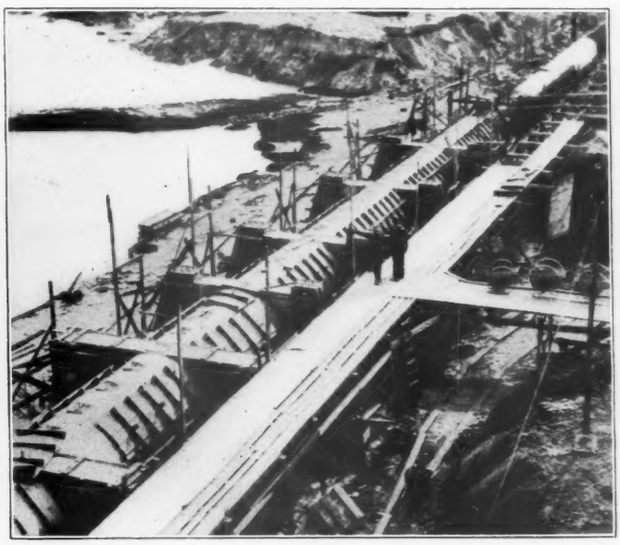
PRESENT-DAY labor-saving machinery, transportation and other modern conveniences are taken quite for granted as part of our daily life. It is only through comparison with the distant past that we are able to realize the tremendous progress made during the past half-century.

In our own nonmetallic-mineral field progress has been made in proportion to that in other fields. Old plants and obsolete methods have been scrapped in favor of the new just as rapidly as in other industries. Comparisons of new developments, however, are usually made with those which preceded them; seldom does one compare a new plant with one of fifty or more years ago.

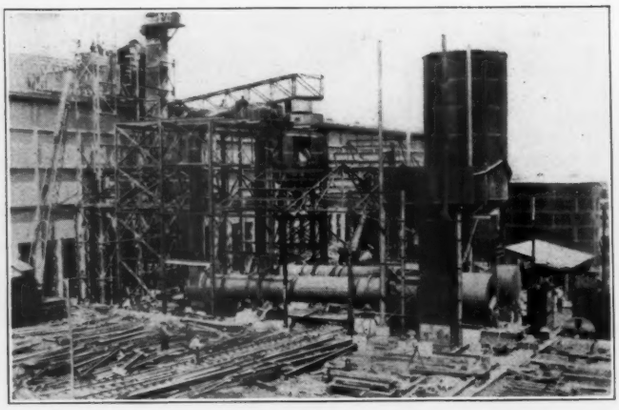
An opportunity to make just such a comparison in the phosphate-rock industry presented itself in the recent completion of a fine new raw-material storeage-and-drying plant in the Florida pebble-phosphate district and in the discovery of an old-time woodcut illustration taken from *Frank Leslie's Illustrated Newspaper* published in 1877. Copies of this paper, long a memory of by-gone days, are now highly prized by collectors and this particular illustration is no less of value as a reminder of "how they used to do it." Perhaps some of the "old-timers" in the phosphate-rock business will recall the early days, when everything was done by hand. The illustration clearly shows the dependence upon hand labor—wheel-barrows, shovels and muscle.

For the picture of the modern phosphate-rock plant we look at the newly-completed plant of the International Agricultural Corp. at Mulberry, Fla., one of the many operations of this concern from Maine to Texas. In addition to the Mulberry mines, and a group of mines at Wales and Mount Pleasant, Tenn., the company owns and operates 27 chemical and fertilizer plants. In size, this new plant, which has a yearly output of 1,500,000 long tons, located on a 43,000-acre tract of land, is a far cry from those of sixty years ago. In modernity it is an excellent example of what modern engineering has to offer. Probably no more men are required to produce this enormous volume of materials—rated in millions of tons—than were required to

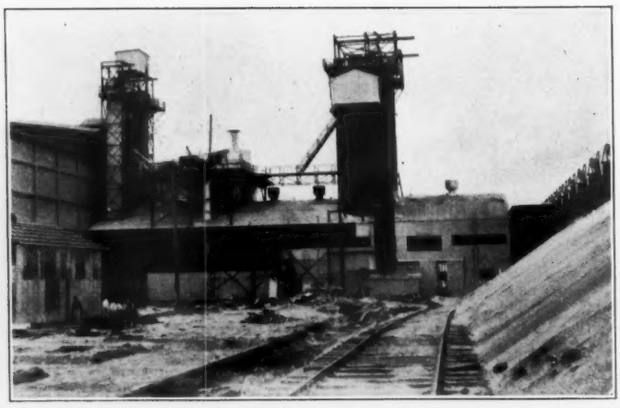
Looking down at the trestle and stock-piles.



Stock-pile tunnel in construction stage.



Drying plant under construction showing equipment.



A view of the new drying plant after erection was nearly complete.

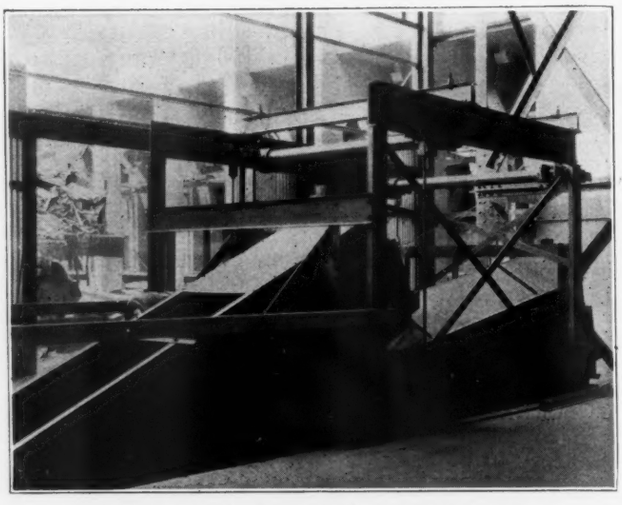
produce but a few thousand tons sixty years ago.

The new plant of the International Agricultural Corp. is an extension of and improvement on its previous facilities. It is the first unit of a large expansion and modernization program which, when finally completed, will displace all former plants and equipment at this location. The first unit, which was begun in November of 1930 and completed in May of this year, consists, briefly, of a raw-material unloading, storage and tunnel-recovery system with a drying and pulverizing plant. It is designed for the production of dried phosphate-rock, both ground and unground in the various market grades—in all, more than a dozen products, each of different specifications.

To J. A. Barr, chief engineer of the International company, goes the credit for the plant design and all engineering in connection with it. Construction of the plant was divided in two contracts, that for pile-driving and general concrete work which was held by Albinson & Co., Bartow, Fla., and that for the steel work, which was held by the Ingalls Iron Works, Birmingham, Ala., and Verona, Pa. The installation of the mechanical equipment and all electric-power distributing equipment was done by the company's own men. The entire work was supervised by R. B. Fuller, manager at Mulberry.

For a more complete picture of the operation of the new raw-material storage system and the new drying plant it will be well to trace the flow of material from its source—the vast open-pit mines. On its extensive acreage of land the company operates four mines and four washing plants with flotation mills in connection. One mine and one wash-house will be described as representative of the group.

A typical pebble-phosphate mine consists of a series of cuts approximately 150 ft. wide, determined by whatever width can be obtained by the reach of the large drag-lines used for stripping the deposit. The cuts are driven to lengths of ½ mi. or more, the limits being property lines, highways, or the limit of economic pumping distance to the nearest wash-house. The depth of a cut is, of course, the depth of the overburden plus the depth of the deposit, or matrix as it is called. All mine cuts are headed by a large drag-line, in this case, a Marion 6-cu. yd. machine equipped with crawlers and fitted with a 165-ft. boom. Because of the weight of a machine of this size, log mats are used as footings for the crawlers. With them no difficulty is experienced in penetrating through swamp lands. The drag-line is always operated from a position near the adjoining worked-out cut so that the overburden may be overcast into it. Usually, the



Automatic scales for weighing the dried rock.

Typical open-pit mining operation showing stripping and hydraulicking methods.

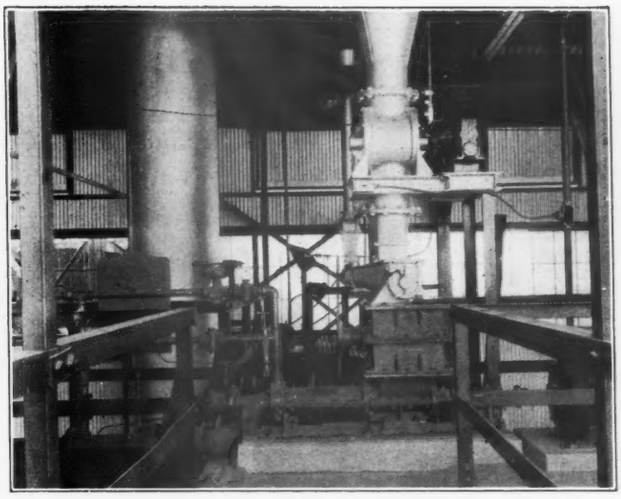
overburden averages 18 ft. in depth, although it occasionally becomes as much as 45 ft. deep.

The matrix is a sedimentary deposit of sea life, the origin of which is definitely ascribed to the fact that this area was once the bottom of an ocean. Chemically the phosphorus content of the pebble-phosphate is usually considered as being in the form $Ca_3(PO_4)_2$ and it is found in a mixture of sand, mud, and clay in a proportion varying from 15 to 30 per cent. rock, the remainder being foreign material. Recovery of the matrix is accomplished by hydraulicking, two or more hydraulic guns being directed at its face. Channels are cut for the passage of the sludge to a sump, where a Georgia Iron Works 12-in. pump delivers the material by a 14-in. pipe-line to a 12-in. "booster" pump of the same

One of the washing and screening plants.

make stationed in the pipe-line between the mine and the wash-house. Both pumps are of special design for this class of service and are direct-driven by 300-hp. General Electric motors. The hydraulic guns are supplied with water at a pressure of 200 lb. per sq. in. from a circulation system in which mined-out pits are used as reservoirs or settling basins. One of the centrifugal pumps in the system has a capacity of 3,000 gal. per min. at a 462-ft. head. It is operated by a 500-hp. General Electric motor and draws its water from a pond in one of the worked-out cuts.

Phosphate-rock sludge from the mines passes



Dust feeders and conveyor with dust-pump installation.

through about 1,500 ft. of pipe to reach the wash-house. Here it is received in a discharge box at the top of the washing plant and is divided for entry into two processing circuits, each of which is identical to the other, the equipment involved being the same. Following one circuit, the sludge will be seen to enter a 48-in. by 12-ft. revolving screen. Here mud balls are eliminated, the phosphate rock passing through 1½-in. perforated plate on the screens. Jets of water added assist in the rejection of the mud and this material finally finds it way by a flume to a waste dump. The phosphate rock then passes into a Georgia Iron Works 20-ft. log-washer for the breaking up and removal of any remaining clay and other foreign material. After this process, a Tyler Hum-mer vibrating screen, fitted with a 1-mm.-mesh wire-cloth panel, screens out minus-1-mm. material, which is sent to a sump for later recovery in the Phosphate Recovery Co. flotation plant. The plus-1-mm. rock continues on to another log-washer for additional scrubbing and then to another Tyler Hum-mer screen likewise fitted with a 1-mm. panel. The "rejects" of this unit are divided and sent over a pair of Tyler Hum-mer double-deck screens fitted with ⅜-in. and 1-mm. panels. With two circuits there are four screens for the final classification of the rock. Two ele-

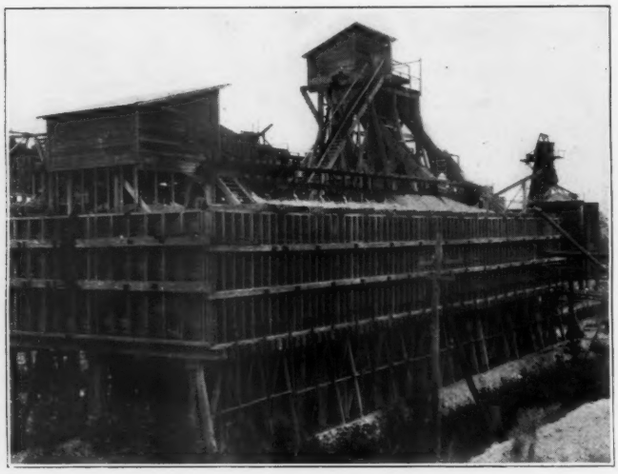
Two of the vibrating screens which classify the washed rock.

These rotary screens reject the mud balls from the rock sludge.

vators stationed directly in front of the screens deliver the material to a storage-and-loading bin, one elevator being used for the plus-⅜-in. material, the other for the plus-1-mm. material. The minus-1-mm. material is flumed to the sump, where, with other material and wash water, it is pumped to the Phosphate Recovery Co. mill.

The wet-rock storage-and-loading bin is divided into three compartments, two of which are used for fine rock and the third for coarse rock. The total capacity of the bins is placed at 1,200 tons. A drag-chain is employed to distribute the rock from the elevators' discharges across the length of the bins.

Materials are delivered to the raw-storage and drying plant by the company's own electric railroad. The equipment in service includes six 30-ton Westinghouse electric locomotives and a number of



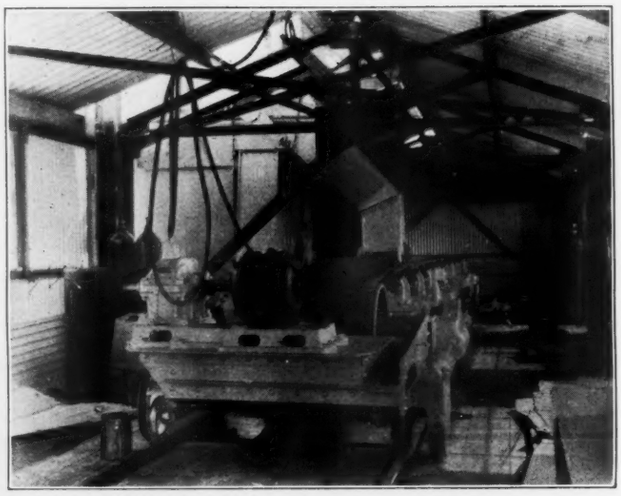
The wet-rock storage and loading bins.

18-ton wooden cars and 40-ton steel cars. From the wash-houses to the drying plants is a distance of approximately 4 mi.

For the new raw-material storage-and-recovery system, the railroad-trestle type of stock-piling was selected with a tunnel-conveyor system for recovery. Its construction necessitated the building of a long earth-fill approach and the rearrangement of

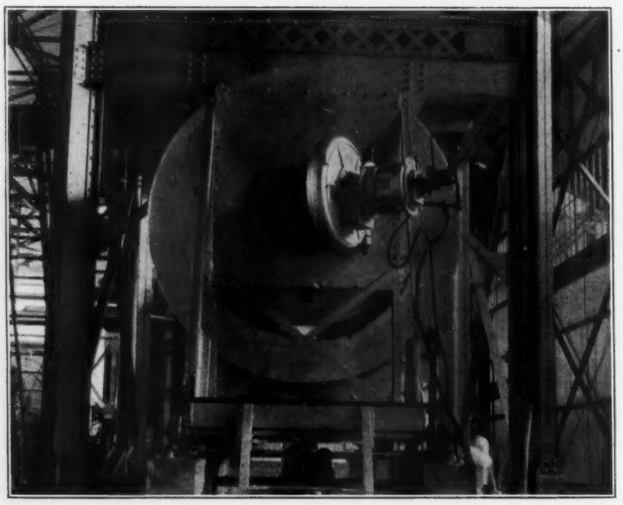
Dust collectors and fans over the discharge ends of the driers.

considerable trackage in order to limit the grade to 2 per cent. The trestle structure is a single-track extension of this approach 30 ft. above ground level and 1,600 ft. in length in a straight line paralleling the dry-rock storage-bin structure. Part of the trestle, 750 ft., is built of timbers, the remainder, 850 ft., is of fabricated-steel construction. The total length, 1,600 ft. is actually used for wet-rock storage, and the material in 880 ft. of its length is recoverable by the tunnel conveyor. The latter is



The shuttle conveyor over the drier feed tanks.

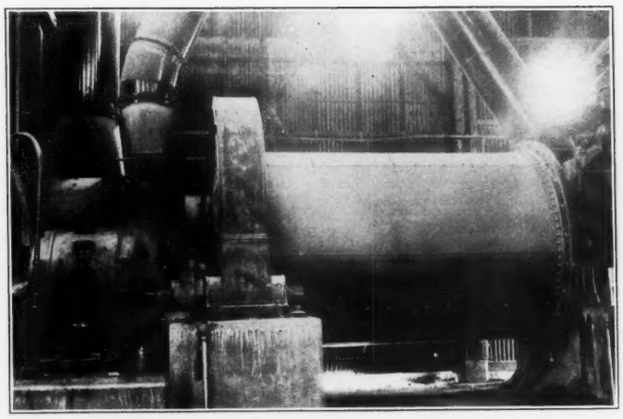
located on the far end of the trestle to serve the new drying plant. Materials on the approach end of the stock-piles are recovered or transferred by a locomotive crane operating on a ground track at the foot of the piles. At a point directly in front of the new drying plant (approximately 275 ft. from the end of the trestle) two steel wet-rock receiving bins are mounted beneath the trestle track.



Firing end of a drier showing the oil burner.

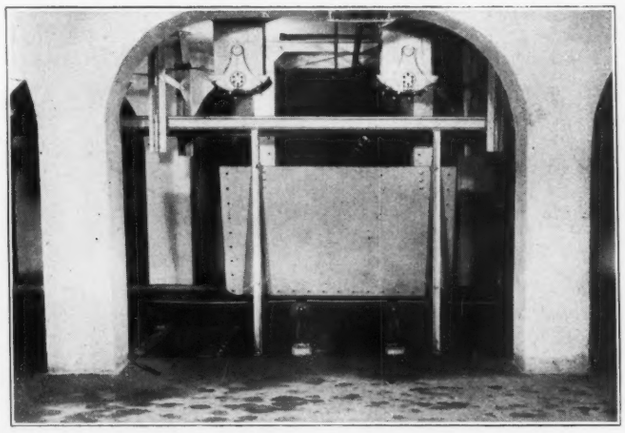
Directly beneath them are the two tunnel cross-conveyors which lead to the drying plant, and material in the bins can be sent direct to the plant by hopper gates over the two cross-conveyor belts. The purpose of these bins is to permit the entry

of special fine and coarse materials to the drying plant from the trestle track. Without them it would be necessary to excavate a space in the stock-pile over the tunnel-conveyor system—a costly procedure.



One of the mills producing pulverized rock.

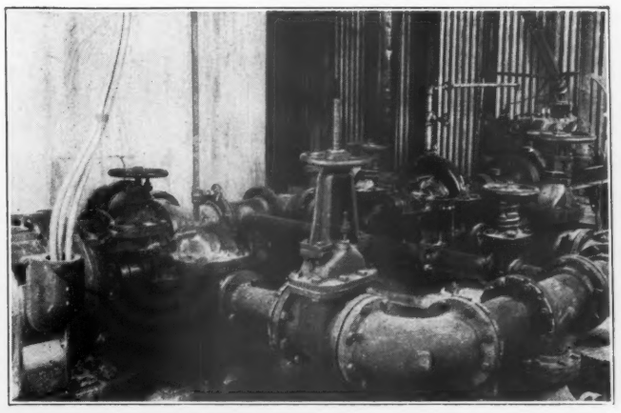
Since there are several sizes of raw wet phosphate rock produced and prepared, besides the dust, the materials-handling and processing facilities are necessarily designed for handling of the two sizes. Therefore, the tunnel-recovery system consists of an almost duplicated system of conveyor and elevators, and these are adequate for handling the several sizes of raw materials. The practice in stocking the raw materials provides for the storage of certain sizes of phosphate rock over one tunnel-conveyor and the other sizes over the opposite



Cross-conveyor in stock-pile tunnel, with material gates overhead.

tunnel-conveyor. Each size of materials is piled according to chemical content, varying from 68 per cent. to 78 per cent. bone phosphate of lime [$Ca_3(PO_4)_2$]. Approximately 300,000 long tons of wet rock can be stored at one time, of which 150,000 long tons is available through the tunnel conveyors.

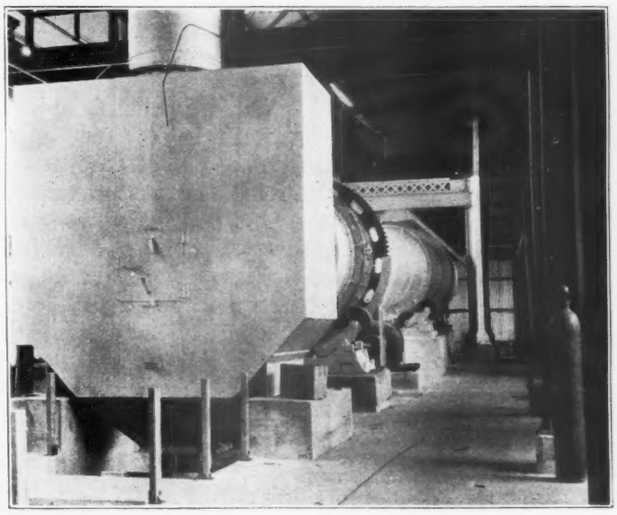
The tunnel is of reinforced-concrete construction with an arched roof. It is 880 ft. long, 7 ft. 6 in. high, and 6 ft. 9 in. wide. It was constructed, of course, before the erection of the trestle and, to place it below ground level, a long trench sufficiently wide to accommodate the forms and the con-



Lay-out of pumps supplying fresh water. De-aërating tank at left.

crete-buggy runway was excavated. At the point where the tunnel cross-conveyors take off for the plant, foundations were built for the two wet-rock bins already described.

Installed in the arched roof of the tunnel are 165



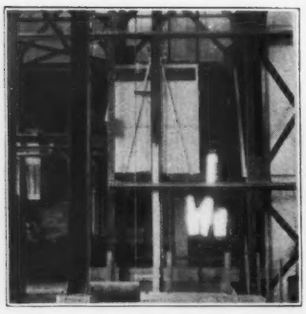
Dust hood on the discharge end of one of the driers.

Robins radial-type gates set approximately on 5-ft. centers. Over the cross-conveyor belts are 24 other gates to permit the loading of materials from the steel bins overhead to the tunnel-recovery system. In the latter system is a series of conveyors which, with a pair of elevators and an overhead shuttle-conveyor, form the transportation medium between the raw-material stock-piles and the drier feed-tanks. It is designed to handle from 300 to 400 long tons of wet rock per hr. The equipment, in flow-sheet order, is listed in the accompanying table.

STOCK-PILE-RECOVERY CONVEYORS AND ELEVATORS

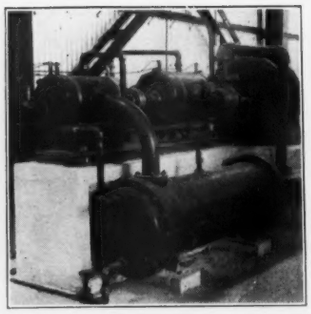
Equipment	Width (in.)	Length Between Centers	Motor Size (hp.)	Drive
Tunnel-conveyor, north.....	30	280 ft.	5	Speed-reducer
Tunnel-conveyor, south.....	30	560 ft. 6 in.	10	Speed-reducer
Cross-conveyors (2).....	30	86 ft.	7½	Speed-reducer
Elevator (2) belt-bucket (2-rows 18-in. by 10½-in. buckets)	40	91 ft. 1½ in.	15	Speed-reducer
Shuttle-conveyor	30	37 ft. 6 in.	7½	Speed-reducer

The materials-handling equipment in this system is standardized as to makes and type. Robins Conveying Belt Co. equipment was selected for the

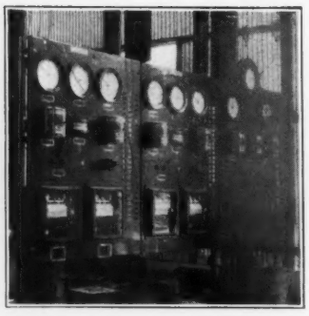


Elevator in drying plant.

One of the booster pumps.



The dust-pump compressor.



Drier control panel.

conveyor and elevator mechanical parts with Republic Belt & Rubber Co. belting. All units are driven through Falk speed-reducers by Allis-Chalmers electric motors.

As the wet rock reaches the shuttle-conveyor above the feeder bins it is discharged to either of them as needed by the 25-ft. travel of the shuttle carriage. The two bins are circular in shape, 20 ft. in diameter and 34 ft. in height, and are built of steel plate. Each bin has a rate capacity of 400 tons.

For the elimination of moisture in the phosphate rock, two rotary kiln-type driers are installed. Both units are of Allis-Chalmers manufacture, 6 ft. in diameter by 60 ft. in length. The combustion chambers, or furnaces, are lined with fire-brick throughout. The driers are operated by individual 100-hp. Allis-Chalmers motors under variable-speed control ranging from 0 to 10 r.p.m. The hoods of the driers are designed for oil-firing, and two Ray industrial-type burners were selected for this installation. Depending on the moisture content of the rock, atmospheric conditions and other variable factors, the capacity of the driers varies from 80 to 120 long tons per hr.

Accuracy of control over the operation of the two driers is provided for by the installation of a well-equipped control-board located adjacent to the firing end of the driers. On the board are mounted Brown Instrument Co. recording temperature meters, as well as draft gauges, r.p.m. indicators, and recording watt-hour meters. The entire panel was erected and wired by the company's own staff.

For the control of dust and the recovery of it as a finished product, each drier's discharge end is fitted with a hood connected to an individual dust-collector system. Both driers are equipped with American Blower Co. collectors, a size 44 unit for one drier and a size 36 unit for the other, the difference in size being accounted for by the greater volume of dust handled in connection with the minus-1-mm. size rock drier. Both collectors are operated by Sirocco fans.

J. A. Barr, chief engineer, and R. B. Fuller, manager, of the Mulberry, Fla., operations.

Scale-house on trestle for weighing car-loads of wet rock as they arrive.

Discharge dust from the collectors is fed through Fuller rotary feeders mounted on the discharge pipes to an 8-in. cross screw-conveyor which, in turn, feeds a Fuller 3-in. pump. The latter sends the dust to inclosed bins in the storage-and-loading building. Compressed air for the pump is supplied by a Fuller two-stage, rotary-type air-compressor, which has a capacity of 360 cu. ft. per min.

In comparing the new drying equipment with the old plant which employed 8 small-size driers, the improvements are obviously many. Through the reduction of units to two large and more efficient driers, heat losses and maintenance costs are greatly reduced. The system in the new plant is greatly simplified and the resultant greater capacity is accompanied by a lower operating cost.

Dried rock is discharged from the drier hoods directly to 24-in. pan-conveyors. The No. 14 drier (the south unit) pan-conveyor leads directly to a Richardson automatic weighing scale. The latter in turn feeds the boot of a Dodge Mfg. Co. 16-in.

bucket-elevator 98 ft. high on centers. Following the elevator, a 24-in. conveyor transports the material to a series of conveyors over the loading bins in the storage building.

Dried rock from the No. 13 drier (north unit) is also received on a 24-in. pan-conveyor, but the latter discharges directly to the boot of an elevator (similar to the No. 14 drier elevator) which discharges to a Richardson automatic scale located in a passageway connecting the top of the storage building with the drier building. A reversible conveyor receives the material from the scale and transports it either to the conveyor system above the storage-building bins or to a 24-in. conveyor leading to the feed bin of the pulverizing mill which is located in a building adjoining the driers.

Pulverized phosphate rock is prepared by a Kennedy-Van Saun Airswept mill. This unit is 6 ft. in diameter and 12 ft. in length and is driven by a 150-hp. Allis-Chalmers motor. It receives dried phosphate rock from a 150-ton feeder-tank mounted overhead, and the finished product, ground by a charge of 14 tons of 1-in. to 3-in. steel balls, is delivered direct to box-cars by an elevator and screw-conveyor system.

Storage and loading facilities for the dried phosphate rock and dust products are furnished by a building erected for this purpose in conjunction with the old plant. It has a capacity for 45,000 tons, and cars are loaded beneath the bins on four tracks. Shipping facilities are provided by the Atlantic Coast Line and Seaboard Air Line Railways. These consist not only of the usual box-cars for interior domestic shipments but special hopper-bottom, hatch-top steel gondolas, ranging in capacity from 80,000 lb. to 140,000 lb., are used for movement to Port Tampa, Tampa and South Boca Grande, where the rock is loaded into ships for coastwise and foreign trade.

Water for the plant and company-owned buildings in the vicinity is supplied from a deep-well pump and gravity-tank system. Because of the presence of hydrogen-sulphide gas in the water the Layne-Bowler turbine pump discharges to a deaërating pipe over a concrete tank. The gas, allowed to escape, is not noticeable in the water supplied to the homes and plant. Two Allis-Chalmers 4-in. by 3-in. pumps, rated at 500 gal. per min. at a 175-ft. head, pump the water to a 20,000-gal. gravity tank which is mounted at a height of 120 ft. above ground level and is large enough to supply ample pressure over the company's property. One of the pumps is direct-connected to a Ford motor and is used in case of power outages for fire-protection purposes. The water supply, in this case, is obtained by a gasoline-engine-driven Ingersoll-Rand air-compressor pumping direct to a deep well, forcing water to the surface where it is directed to the pump suction reservoir.

Equipment in the entire plant, so far as possible, is provided with Timken anti-friction bearings.

Improved Concrete-Mixing Methods Greatly Increase Production

Research work and experiments conducted by the bureau of public roads of the Department of Commerce in the past year have so improved methods of mixed concrete production as to make possible a 50-per cent. increase without loss of quality. This declaration by Thomas H. Mac Donald, chief of the bureau, is somewhat qualified by the following statement:

"Of course, not all jobs on which studies have been conducted have yielded such gratifying improvement in the rate of production. On the other hand, very few projects have been found on which some definite increase could not be obtained without corresponding increase in the cost of operation. The possibilities can be appreciated from the fact that, on what might be called average jobs, nearly half of the time of the crew is unproductive as measured by the possible output of the mixer, while on the above-mentioned project on which asphaltic concrete was placed at an average rate of over 150 tons an hr., less than 3 per cent. of the crew's time on the job was unproductive."

The project referred to by Mr. Mac Donald was executed in Monterey County, Cal.

The department found in its experimentation that the more modern 27-E concrete pavers can handle without difficulty a batch at least as large as 35 cu. ft. without any sacrifice of either strength or uniformity. The tests further demonstrated that a 33-cu. ft. batch, when mixed during the period indicated by the batchmeter setting of 50 sec., produced as strong and uniform concrete as did the standard batch when mixed either 50, 60 or even 80 sec. These specifications make possible an increase in actual production of approximately 27 per cent. over the previous specifications, which required a mixing time of 60 sec. and a batch of not to exceed 30 cu. ft.

In the Monterey project, where all the improved methods were put to test, a statewide record of 802 tons of asphaltic concrete in an 8-hr. day, was increased to 1,204 tons in the same number of hr.

It is the plan of the bureau to continue its experimentation. Experts will be furnished contractors in so far as the size of the bureau's staff will permit.

Observations by Mr. Mac Donald, based on the bureau's studies, include the following:

For a constant sand-cement ratio both the average strength and the uniformity in strength of a concrete pavement slab will be decreased by increasing the percentage of coarse aggregate in the mixture beyond the amount ordinarily used in practice.

When very dry mixtures are used (less than 2-in. slump) the strength of the pavement slab will be lower and the amount of honeycomb in the concrete will be greater than when concrete of medium consistency is employed (2-in. to 3-in. slump).

New York Crushed-Stone Producers Hold Annual Meeting at Syracuse

THIRTY-ONE members of the New York State Crushed Stone Assn. met at the Syracuse Hotel, Syracuse, N. Y., on December 11 for the annual meeting of that organization. J. L. Heimlich, Le Roy Lime and Crushed Stone Corp. of Le Roy, N. Y., was elected president for 1932, succeeding A. S. Owens of Eastern Rock Products, Inc., Utica, who had served during the past year.

Other officers chosen at the meeting were: H. E. Rainer, Federal Crushed Stone Corp., Buffalo, vice-president; and G. E. Schaefer, The General Crushed Stone Co., Rochester, secretary and treasurer.

Considerable constructive work was accomplished during 1931 and the association is in good financial condition, it was brought out. The Auditing Committee reported a balance in the treasury of $350.31. The recommendation of the treasurer to establish a change in the financial structure of the association was submitted to a committee to report at the next meeting.

A. G. Seitz, chairman of the Contact Committee, discussed the washed-stone situation in detail. It was felt that the order of State Highway Commissioner Brandt of Albany to demand washed, or otherwise equally cleaned, stone in the 1932 specifications, was subject to more than one interpretation and that it would be well to have a more definite understanding on the details of the order. The meeting authorized the committee, composed of Mr. Seitz, H. E. Rainer and John H. Odenbach, to give it further study and later in the day this committee urged that another meeting be arranged with the highway commission in order further to clarify the situation.

President Owens spoke of information he had received relative to a change in the gravel specifications to permit the acceptance of less than 90 per cent. crushed gravel as optional with crushed stone. It was suggested that the Contact Committee consider the matter further.

F. C. Owens, chairman of the Transportation Committee, reported that there were two plans considered in connection with the special cars to the national convention at Pittsburgh, one a Monday night trip to arrive Tuesday morning, and the other a day trip starting Monday morning. It was voted to start the special cars from Albany and Syracuse Monday morning, January 18, to arrive in Pittsburgh that evening. It is expected that about the same delegation from New York will attend as has been the case in previous years.

Harry R. Hayes, secretary of the New York State Contractors' Assn., then addressed the meeting in regard to suggestions for 1932 legislation proposed for submission to the joint legislative committee on lien-law revision. Most of the objectionable features of last year's Fearon bill, which passed both houses of the legislature but was vetoed by Gov. Roosevelt, seem to have been corrected in Mr. Hayes' proposals, and it is expected that the new bill to be introduced may now be acceptable. The crushed-stone industry which has fought for a bonding law for materials, will receive added protection if the proposed bill becomes law, and it is generally believed that in such an event the producers should be willing to compromise.

It was decided that the next gathering would be in the form of a dinner meeting to be held January 20 at Pittsburgh in conjunction with the national convention.

At the close of the meeting, President Owens made a farewell address thanking the members for their coöperation during the year, and extending his best wishes to the new officers.

The following attended:

Wm. Anderson, Hercules Powder Co., Buffalo, N. Y.
Hiram Barnes, Sweeney & Boland, Rochester, N. Y.
M. D. Caldwell, Atlas Powder Co., Rochester, N. Y.
Harvey N. Clark, Dolomite Products Corp., Rochester, N. Y.
Milo Crouse, L. & M. Stone Co., Prospect, N. Y.
Claude Ellis, Worlock Stone Co., Canastota, N. Y.
W. E. Foote, Wickwire Spencer Steel Corp., Gasport, N. Y.
Harry R. Hayes, N. Y. Chapter, A. G. C. A., Albany, N. Y.
A. J. Hooker, Buffalo Crushed Stone Co., Buffalo, N. Y.
Geo. E. Merchant, Le Roy Lime & Crushed Stone Corp., Le Roy, N. Y.
Wm. McGrew, L. & M. Stone Co., Prospect, N. Y.
F. F. McLaughlin, General Crushed Stone Co., Syracuse, N. Y.
H. M. McNabb, Federal Crushed Stone Corp., Buffalo, N. Y.
John H. Odenbach, Dolomite Products Corp., Rochester, N. Y.
A. S. Owens, Eastern Rock Products, Inc., Utica, N. Y.
F. C. Owens, General Crushed Stone Co., Syracuse, N. Y.
L. B. Perry, Acme Road Machinery Co., Rochester, N. Y.
Eugene Rago, Rago Brothers, Syracuse, N. Y.
H. E. Rainer, Federal Crushed Stone Corp., Buffalo, N. Y.
H. J. Russell, Jointa Lime Co., Glens Falls, N. Y.
Fred Rutschow, Mohawk Limestone Products Co., Mohawk, N. Y.
Jas. Savage, Buffalo Crushed Stone Co., Buffalo, N. Y.
Geo. E. Schaefer, General Crushed Stone Co., Rochester, N. Y.
F. W. Schmidt, Jersey Quarries Co., Morristown, N. J.
A. J. Seitz, General Crushed Stone Co., Syracuse, N. Y.
A. F. Sickles, Dolomite Products Corp., Rochester, N. Y.
N. S. Snyder, Link Belt Co., Buffalo, N. Y.
E. E. Wilson, Pekin Stone Products Co., Lockport, N. Y.
M. J. Wurtenburger, Pekin Stone Products Co., Lockport, N. Y.

A Correction

An article in the December 2, 1931, issue of PIT AND QUARRY describing the recently-constructed pack-house of Lone Star Cement Co., Virginia, stated that the structure and storage silos were built by the Rust Engineering Co. of Pittsburgh from plans furnished by the Macdonald Engineering Co. C. G. Thornburgh, manager of the industrial engineering division of the Rust Engineering Co., reports that his company designed the structures complete, including the caissons, and that the machinery for the pack-house was designed by the International Cement Corp.

Coöperation or Competition in the Ready-Mixed Industry?

Truck fleet of Superior Ready-Mixed Concrete Co. of Cincinnati.

Cincinnati Concern Works Out Seemingly Ideal Arrangement with Supply Dealers

JUST whose business am I?

Ready-Mixed-Concrete, the squalling new offspring of the aggregate and construction industries, frequently flings that query into the faces of its producers who find themselves in competition with their former customers. With no less than four types of businesses introducing it as an extension to their markets, overlapping is bound to occur to the decided disadvantage of the companies concerned. The net result has often been the loss of former customers, and, not only that, but frequently these former customers set up their own plants and offer stiff competition by dividing what business the community provides.

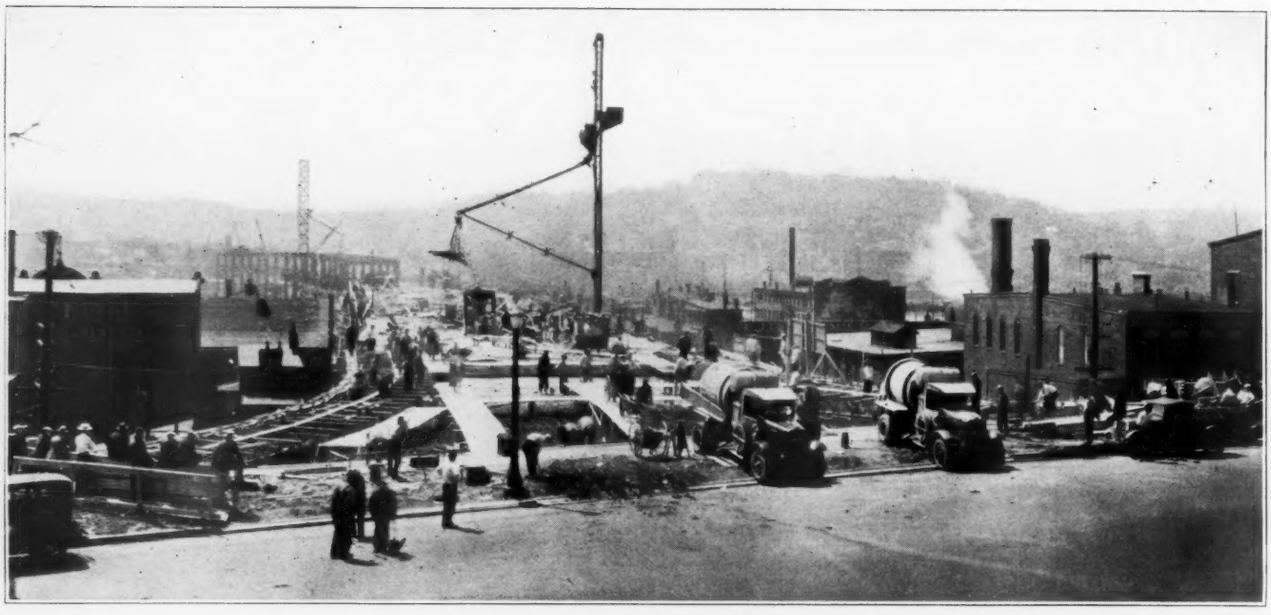
Take, for example, the aggregate producer who finds a large market in metropolitan areas through building-materials supply dealers. The producer's entry into the pre-mixed concrete field invariably offers competition to his city agent, the supply dealer. The loss of the dealer business is severely felt, especially so when the loss of the small-contractor and private-outlet accounts carried by these dealers is taken into consideration. Not infrequently the supply dealer sets up his own pre-mixed concrete plant or makes arrangements with some producer of it. Then, too, the aggregates producer in "going pre-mix" sometimes takes away a good share of the small industrial and private concrete business from his contractor customers. Small consumers, instead of placing their business with contractors, build their own forms and order the concrete direct from the aggregate producer's plant.

For the building-materials supply dealer who enters the pre-mixed-concrete business similar competitive problems exist. He, too, loses contractor friendships when he sells the small consumer direct. If he does not offer pre-mixed concrete to the contractor trade, large construction-materials contracts may be lost to his competitor who does, particularly so when the bidding is done on a lump-sum basis. Recent disclosures of unfair trade practices by supply dealers in quoting materials on the lump-sum basis emphasize the sharpness of this competitive condition. In one large city pre-mixed concrete is frequently offered to the contractor at cost, provided the supply dealer gets the material business. Naturally, competitive dealers, not equipped to offer concrete, lose before the race is begun.

Obviously, the answer to competitive problems such as these lies in a thorough analysis of conditions in the market considered, these conditions being weighed with all possible business arrangements with dealers and other customers worked out prior to the erection of the plant.

In Cincinnati a pre-mixed-concrete producing company has worked out a seemingly ideal business arrangement whereby coöperation with the producer, supply dealer and contractor is the keynote. This company, the Superior Ready Mixed Concrete Co., does not engage in any of the businesses just mentioned; rather, it can be likened somewhat to a trucking-contracting firm; nevertheless its business is strictly the sale and production of concrete. The company is a partnership of three men, Jos. A. Byrnes, Walter E. Howard and Alfred Deckebach. Mr. Howard is general manager of the enterprise.

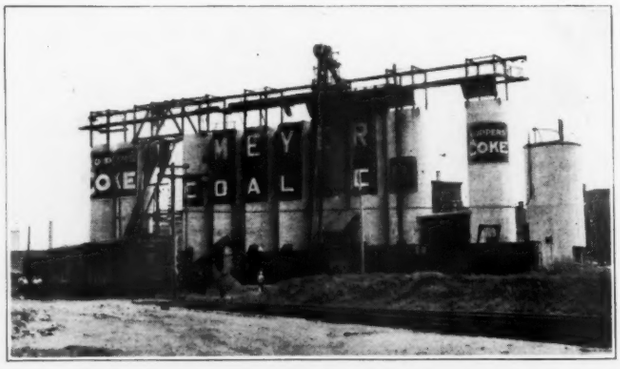
The Superior method invites the coöperation and business relationship of the building-materials sup-



Trucks delivering concrete to a viaduct job in Cincinnati.

ply dealers who are not already producers of concrete, but who wish to add it to their lines. The dealers erect no plant other than aggregate-weighing batchers, which are ordinarily used for the weighing of aggregates for city truck deliveries; the Superior Ready Mixed Concrete Co. owns and operates a fleet of truck-mixers. When the dealer gets an order for concrete, the Superior company moves a sufficient number of trucks to the dealer's yard to handle the order, uses the dealer's aggregates and cement from his yard stocks and delivers the truck-mixed concrete to the customer's job. Responsibility for the concrete is borne entirely by the Superior company, which avails itself of the best technical supervision and employs the latest and best methods and equipment for this type of business.

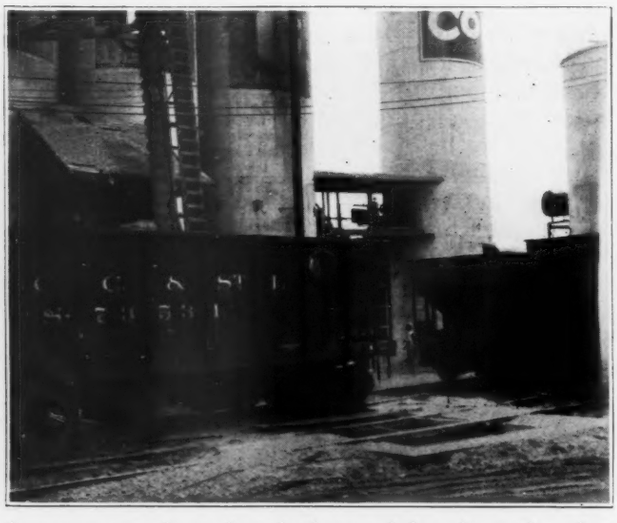
The features of a scheme such as this are many; they can be summed up as follows: (1) The supply dealer is enabled to offer pre-mixed concrete to his line without investing in a plant; (2) the dealer sells the concrete and receives a commission on the sale; (3) the dealer gets the sale of the raw materials and his relationship with the producer is the same as formerly; (4) the aggregate producer and the cement manufacturer's trade positions are in no way jeoparded; (5) the truck-mixer fleet operator gets a wider scope of business, takes business



Yard No. 1 at Adam F. Meyer Coal & Supply Co.

away from no one and is in a position to operate his fleet more efficiently and economically.

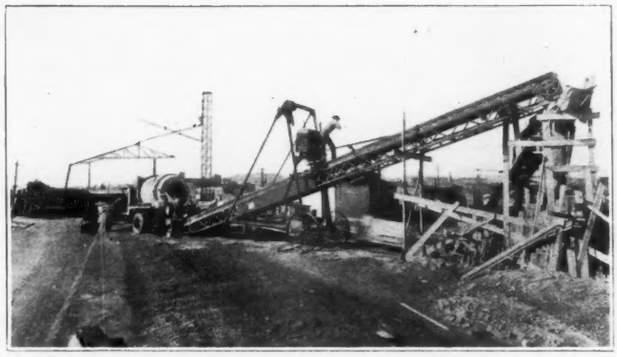
So successful has this arrangement worked out for the Superior Ready Mixed Concrete Co. that the 1931 business up to the present time has averaged 3,500 cu.yd. a month, despite the competition of five or more other firms in the "ready-mix" business. In August the company's business reached 11,200 cu.yd., a record for a Cincinnati producer. Under contract during the summer of 1931 were 120,000 cu.yd. of concrete, the Western Hills viaduct (part of the Cincinnati Terminal project) alone requiring 70,000 cu.yd. City of Cincinnati contracts total 10,000 cu.yd. for 1931 and a portion of the local street-railway business amounts to 6,000 cu.yd. of concrete for this year. A contract for the retaining walls of the new station of the Cincinnati Terminal Co. calls for 5,000 cu.yd. of concrete and



Aggregates are dumped to the hopper below the tracks, where an elevator raises them for distribution to the silos.

another contract, the Eighth Street viaduct crossing, calls for 6,500 cu.yd.

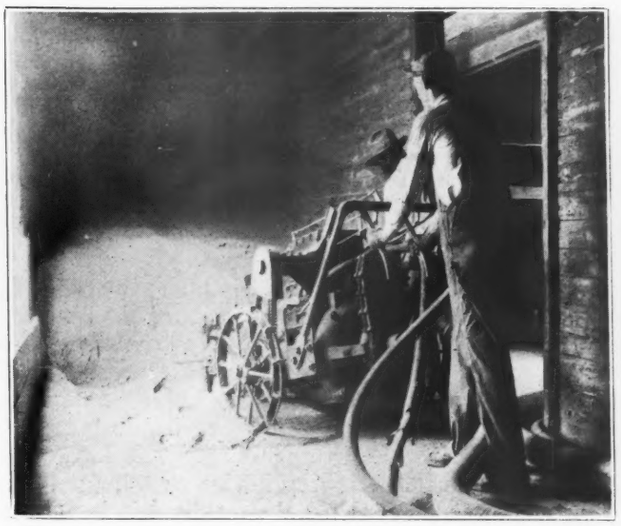
In handling contracts such as these, the Superior company has the added advantage of a small investment involving little or no equipment other than truck-mixers. It stocks no aggregates or cement, and its accounts receivable are limited largely to the names of the supply dealers working in cooperation with it. Flat prices are issued to the dealers for the mixing and hauling of the concrete, and the Superior company cares not what the dealer sells it for. In this way the dealer can sell the concrete at whatever prices he sees fit to quote and on terms that accord with his own judgment. In bidding on large projects, the Superior Ready Mixed Concrete Co. may quote direct to the contractor but always in coöperation with the dealers involved under the same arrangement as already described.



Concrete truck discharging to a portable conveyor for placing.

Delivery is usually worked from the yards of the nearest coöperating dealer.

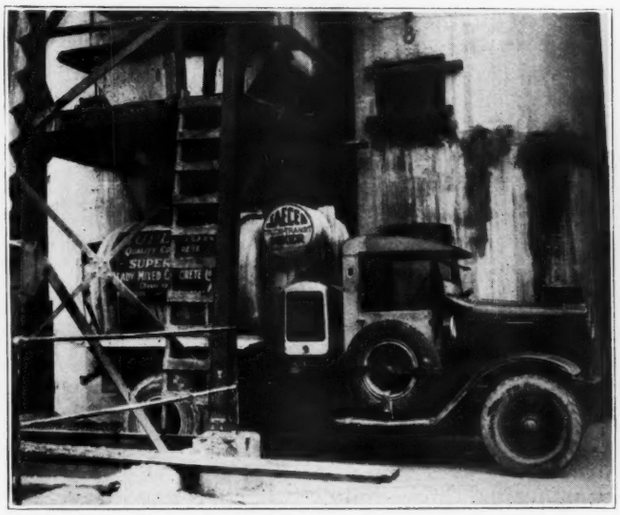
A good picture of the Superior method can be obtained at the yard of the Adam F. Meyer Coal & Builders' Supply Co., the No. 1 dealer yard at which the Superior company operates. The No. 2 yard is located at Oak St. in St. Bernard; the No. 3 yard on the Plainville Pike in Mariemont; the No. 4 yard is that of the Crew Builders' Supply Co. in Norwood; the No. 5 yard is that of the Hilltop Builders' Supply Co. in College Hill. The Adam



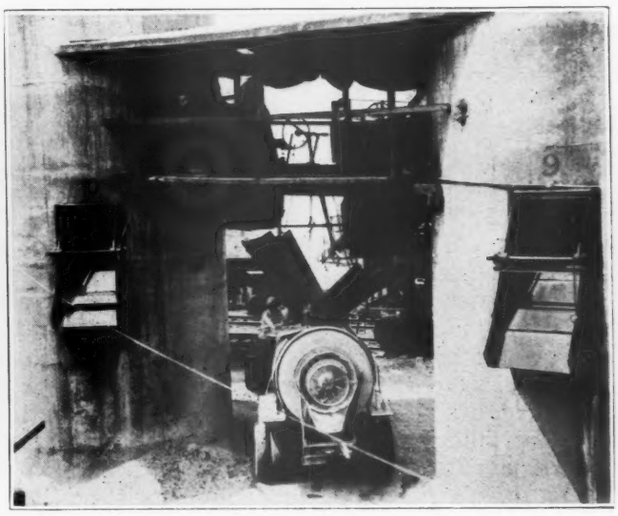
Cement unloader operating in a box car.

F. Meyer yard is centrally located and has unusually good railroad facilities at the new Cincinnati Terminal freight-yard. Four spur tracks which enter the yard provide capacity for 27 railroad cars. Three switches of cars are provided daily by the terminal company.

The Meyer yard is typical of coal yards the country over, consisting of a row of silo-type bins with a system of mechanical unloading of cars and loading of silos. In the row are 10 bins (designed by the Gifford-Wood Co.), exclusive of a smaller one designed especially for the handling of cement. Each silo bin is 16 ft. in diameter and 60 ft. in height with a 6-in. reinforced-concrete circular wall. The bins are supported on heavy piles placed in a mat formation. Each bin is capable of storing 450 tons of materials available for truck loading. Six silos handle concrete aggregates only; the others coal and coke. The storing of aggregates is such that three alternate bins carry three different sizes of gravel; the bins intervening carry sand. Thus, No. 5 bin carries ¾-in. gravel and No. 6 bin, sand; No. 7 bin carries 1-in. gravel and No. 8 bin sand; No. 9 bin carries 1½-in. gravel and No. 10 bin sand.



Loading a truck with aggregates and cement for mixing en route.

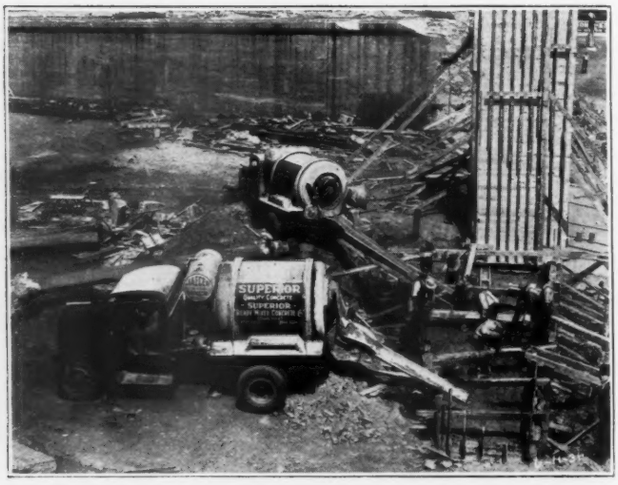


One of the aggregate-batching units loading a batch truck.

Under this arrangement, three pairs of aggregate bins are available, and, therefore, three complete aggregate-weighing units could be set up, each independent of the other. At present two separate aggregate-weighing units are installed and in operation. Aggregates are purchased from near pits, usually where 12-hr. rail service is available.

Cars of aggregates are unloaded at either of two unloading points, one being a double-track hopper with an elevator and shuttle-conveyor system for distributing the materials to the bins; the other is a Gifford-Wood automatically-operated skip-bucket system. The latter is particularly useful in the handling of coal, since the skip-bucket descends to the level of the coal in the silo before dumping, thus preventing breakage of the fuel. As noted, it is entirely automatic in operation. The bucket is loaded by a special tripping device on a hopper below one side-track. Upon being filled it is drawn to the top of the silo-bin structure, where it travels on shuttle rails to the desired bin for unloading. This equipment has access to all 10 silos and is used for handling aggregates or coal. It has a capacity of 60 tons per hr.

The double-track unloading hopper system has access to the aggregate bins only and is especially designed for rapid unloading of the cars with the minimum of car shifting. The track hopper is equipped with a 24-in. belt-conveyor which feeds the boot of a Gifford-Wood bucket-elevator. This is 87 ft. high on centers and has a rated capacity of 150 tons per hr. It is driven by a 20-hp. motor. An 18-in. shuttle-conveyor, located on the tops of



Two trucks chuting their loads to bridge-foundation forms.

silos No. 5 to 10, receives the aggregates from the elevator and distributes them by means of a tripper to their respective bins.

Bulk cement is purchased in carloads as in all modern pre-mixed concrete operations. A separate track and a special inclosed platform built alongside enables 3 cars to be "spotted" at one time. By means of a Fuller-Kinyon portable unloader the cars are unloaded one at a time without further "spotting," the unloader being moved from car to car on the platform. Separate hose-outlet stations at each car position provide connections for the pump utility lines. Cars are unloaded at the rate of one every 3 hr. The cement is pumped by a 4-in. line over a distance of 220 ft. to a 2-compartment 1,500-bbl. silo-type bin, 16 ft. in diameter and 35 ft. high, built of reinforced concrete. Its construction allows trucks to drive underneath for the loading of weighed cement batches. A motor-operated valve, controlled from the ground level, enables the cement to be piped to either compartment as desired.

For batching the concrete materials to the truck-mixers two aggregate-weighing units and one cement-weighing unit are provided. Between the No. 9 and No. 10 silos are Butler weighing hoppers,

Street paving, too, is an important market for the company's product.

mounted on a special platform to load trucks underneath. This equipment has a capacity sufficient for a 3-cu.yd. batch, there being a separate unit for weighing sand and another for weighing the 1½-in. gravel. Both have Howe beam-scales equipped with tell-tale dials for rapid weighing, and both discharge by chutes to the truck-mixer awaiting beneath. On the No. 7 and No. 8 bins a Superior side-mounted batching unit is mounted. This unit, which handles 3-cu.yd. batches, supplies 1-in. gravel and sand when needed.

Cement is batched by a Butler weighing hopper mounted in the cement silo-bin directly over the truck passageway. Adjacent to it is located a 200-gal. calibrated water-measuring tank which is equipped with the latest vacuum-break volume control and rapid refilling devices.

Included in the Superior Ready Mixed Concrete Co. fleet of trucks are 10 Jaeger 2½-cu.yd. individual motor-driven Truck-Transit mixers mounted on International 3½-ton trucks. This fleet is augmented, when necessary, by additional trucks from another company held under an optional service contract. The fleet, as pointed out previously, is operated from yard to yard wherever the daily volume of business happens to fall. Their movement at the Adam F. Meyer Coal & Builders' Supply Co. is, of course, facilitated by this extraordinarily-well-equipped yard. An incoming truck driver, upon arrival, immediately reports to the main office

(Continued on page 34)

Effect of Time in Transit on Strength of Ready-Mixed Concrete

A Discussion of the Late Prof. W. A. Slater's Paper on This Same Subject

By LEWIS A. PERRY

Superintendent, Tru-Mix Plants, Pioneer Sand & Gravel Co., Seattle

PROF. SLATER'S paper[1] is interesting and presents some information that engineers in general should have. From the facts stated, conclusions slightly in disagreement will probably be drawn by different readers.

The writer thinks that a composition analysis of mixed concrete is unreliable unless the specimen is large enough to render the procedure impractical. Certainly some breaking down of aggregates will occur under continued mixing, but, if the material is reasonably sound, this should be very slight. It frequently happens that even clean aggregate will contain considerable dust or other fine material adhering to it. Such "fines" may be present but unaccounted for in the analysis of aggregates at the time of proportioning. The mixing action would dislodge these particles so that their presence would be reported in a composition analysis.

It is noted that the decreased slump due to prolonged agitation is in close conformity with the strength increase, and the question may be asked if these strengths could not be developed by simply limiting the mixing water to produce that slump and strength at the time of normal mixing. The slump-strength relations of the author's four series are as follows:

Series	Average Strength Variation (*lb. per in. slump*)
A	99
B	165
C	300
D	187
Average	188

While these values are not entirely uniform, the general average is just about the variation one would have expected, had consistencies varied in the mixer, and if cylinders had been cast there. It follows that there is the same general companionship between slumps and strengths regardless of the time in the conveyor. In other words, if, for instance, in series B the mixture had originally been a 1.3-in. slump in the mixer instead of 7.3 in., the 4,245-lb. strength or more might have been developed by specimens MB1, MB2, and MB3. Also, if the 7.3-in. slump was necessary for practical placing purposes, the batch at 6B1 must have had considerable secondary gauging water added to restore this consistency. Such additional water would probably have carried the strength finally somewhat below the 3,255-lb. strength.

The cause of the stiffening of the batch of concrete under continued mixing is apparently not yet definitely established. In fact, the existence or extent of this action is probably not generally recognized. The writer has formed the opinion, from contact with extensive operation of central-mixing plants, that the cement paste under certain conditions undergoes a change of state similar to cream that has been whipped. This "whipping" also seems to bulk the paste and to create the effect of richening. It is noted that a paste of low water-cement ratio reacts readily, or whips quickly, whereas the high ratio pastes of lean mixes are slow to show this effect. It seems reasonable to suppose that this is because the rich paste has enough "body" readily to retain the minute air bubbles that cause "whipping," and that the lean paste, resembling a low-grade cream, has not.

Time of mixing is a subject analogous to that of Prof. Slater's paper, and one that deserves to be brought up to date. Unfortunately the time-honored Abrams time-strength curve (reported in Proc. Amer. Conc. Inst., 1918) has been regarded authoritatively by those who have not taken the trouble to investigate the applicability of that test procedure to modern mixing methods and equipment. The mixer used by Abrams, in both type and size, failed to represent good field mixers of 13 yr. ago, much less present-day equipment. The application of the conclusions of that investigation

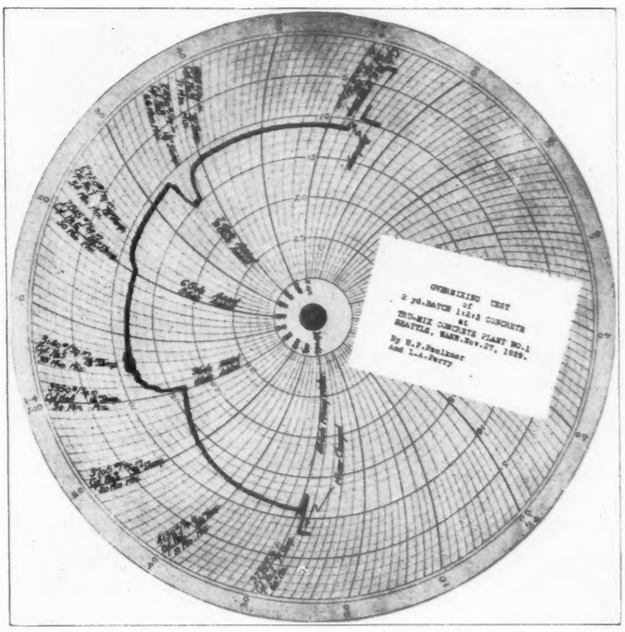


Fig. 1. Chart showing mixing of a 2-cu.yd. batch for a period of 94 min.

[1]Slater (W. A.). *Effect of Time in Transit on the Strength of Ready-Mixed Concrete.* PIT & QUARRY, Sept. 9, 1931, pp. 53-62.

erning the operation of modern motor-cars by safe traffic rules for the 1917 "flivver."

Fig. 1 is a photograph of a Mixometer chart, showing the mixing by a 56S Rex mixer of a 2-cu. yd. batch of 1-2-3 concrete for a period of 94 min. The purpose of this investigation was to determine the effect of prolonged mixing upon the strength and consistency of concrete. Unfortunately only one cylinder was made at each sampling, except at the end of the mixing. However, the facts, that this work enjoyed the high technique of H. F. Faulkner (then engineer of tests of the City of Seattle) and that the individual cylinders were uniform and logical, speak for the reliability of the conclusions.

It is noted that when the batch entered the drum at 9:28:45 a.m., the gauge rose rapidly from 8 to 13 deg. This indicates the harsh unmixed condition of the mass. At 9:29:30 the needle had settled back to 11. This required, as nearly as one can read the chart, about 45 sec. At that point the greatest workability existed with a given water content, indicating that the mixing was complete. The Mixometer registration of 11 deg. was associated with a slump determination of 7 in. From this point on the stiffening of the mix was indicated by the gauge curve. The slumps were in close agreement: At 10 min. a 6¼-in. slump was found, at 20 min. a 3½-in. slump, and at 30 min. only a 1¼-in. slump. The four cylinders taken at these times tested as follows:

Time	Strength
1 min.	3,790 lb.
10 min.	4,130 lb.
20 min.	3,705 lb.
30 min.	3,950 lb.
Average	3,894 lb.

These four specimens were quite uniform and indicate that the only change that took place during this period was one of consistency. Strength was apparently unaffected. The workability of the batch, judged by appearance and handling of the specimens, had certainly suffered to the extent indicated by both the Mixometer and the slump test.

At this point it was decided to add enough water to restore the original consistency. The curve shows where this was done in two general groups of 2- and 3-gal. additions. The first, with a total of 12 gal., did not suffice, so an additional 9 gal. was added. The gauge and slump tests were quite reasonably in agreement at this time (10:05 a.m.). The cylinder taken at this point showed a decided strength loss due to the added water, so the conclusion was reached, that, where a given consistency must be maintained, prolonged mixing is harmful, because secondary gauging water must be used and this raises the effective water-cement ratio and depletes strength.

This was shown at the end of the 35-min. period and it is reasonable to suppose that this effect would have existed to a lesser degree at any other time during that period.

From 10:05 to 10:20 the "stiffening" curve again developed. It is noted that this was much less pronounced than during the first period. The writer thinks this is because the paste, becoming thinner, had lost much of its ability to entrain air bubbles.

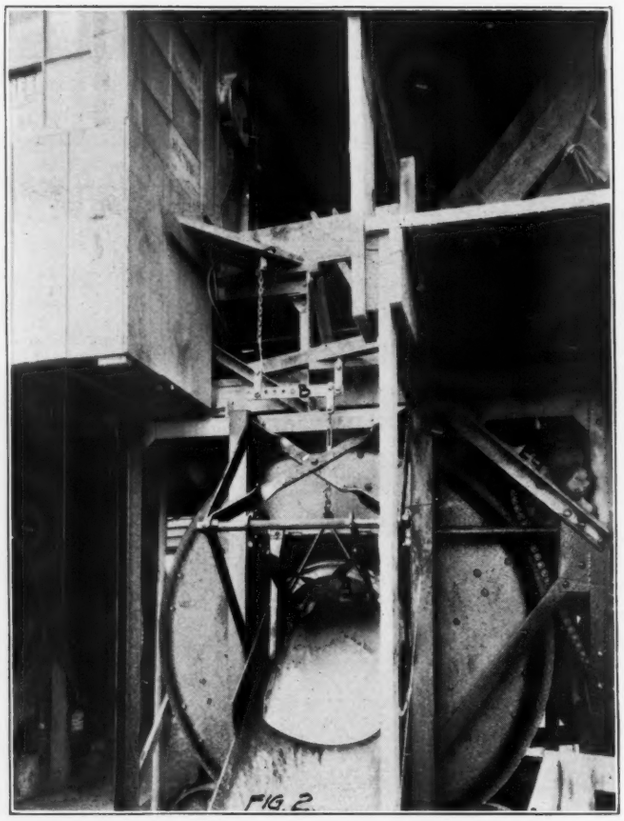


Fig. 2. Receptacle "A" catches streams from buckets. Load is reduced by lever "B" and converted from weight to pressure by oil bellows "C." Gauge "D" records pressures.

At 10:20 water was again added to restore the consistency to its original condition. It is noted that the gauge and slump tests are again in close agreement at this point. Why the cylinder at 10.20 indicated a strength loss is not clear. The lower value at 10:24 is natural since a surprisingly great amount of secondary gauging water was necessary to develop the additional 2-in. slump.

From this point to the end of the mixing a consistent strength loss was shown by each specimen or group, even when no water had been added.

The occurrence at 10:34 a.m., indicated by the pronounced curve deformity, was a decided surprise to the observers, and the writer does not profess ability to explain it. It is worthy of note that at this time the temperature of the batch had risen to considerably above blood heat. (Unfortunately no thermometer was provided to determine temperatures.) The mix at 10:36 had assumed unusual characteristics. It was decidedly sticky and the cement paste appeared to have been bulked. Sixteen gallons of water was added and at 10:40 again a 7½-in. slump agreed closely with the 11 gauge reading. Fortunately, at 11:03 it was possible to cast a series of 3 cylinders. These were very uniform, with an average of 2,008 lb. per sq. in., or about 52 per cent. of the average of the first 4 specimens taken within the first 30-min. period. The unusual character of the mix at 10:36 is in-

dicated by the failure of the slump and the Mixometer to agree. Under this condition the slump determination was not representative of flowability but the Mixometer was.

This stiffening of concrete under prolonged mixing varies from the conditions found by Prof. Slater only in degree. In the conveyor Prof. Slater's test batches lost an average of only 1 in. in slump per 27 min. of agitation, whereas in this mixing test 1 in. of slump was lost with each 5.4 min. of mixing, which clearly shows the difference between mixing and agitation (too frequently confused). In view of the very slight stiffening found in the conveyor, under normal periods of transit, it is improbable that secondary gauging water would ordinarily be used. It is probable that the paste bulking at normal periods will compensate in terms of workability for the stiffening. The writer thinks, however, that, if the drum speed were reduced from 8 to about 3 r.p.m., the stiffening would be reduced, and that greater benefits would be gained.

Figs. 2 and 3 are photographs of the Mixometer by which the record (Fig. 1) is made. This device is primarily an operative consistency gauge and timer; however, one of its important functions is to reveal the time or point at which a "mixed" condition is reached. This point may be designated as "the condition of greatest fluidity or workability with a given amount of mixing water."

This is shown on Fig. 1 at 9:29:30 a. m. It will be noted that the condition just previous to that point was much less fluid, and that from this point on a gradual stiffening occurs. In other words, at one certain point for each set of conditions the complete mixing has been accomplished, beyond which it is useless to consume power and wear equipment. The above reference to "each set of conditions" is meant to be pointed, because of the variable factors that tend to determine the proper mixing time. The important factors are: (1) Characteristics of the cement; (2) richness of mixture; (3) consistency of mixture; (4) rate of water feed; (5) size of coarse aggregate; (6) type and size of mixer.

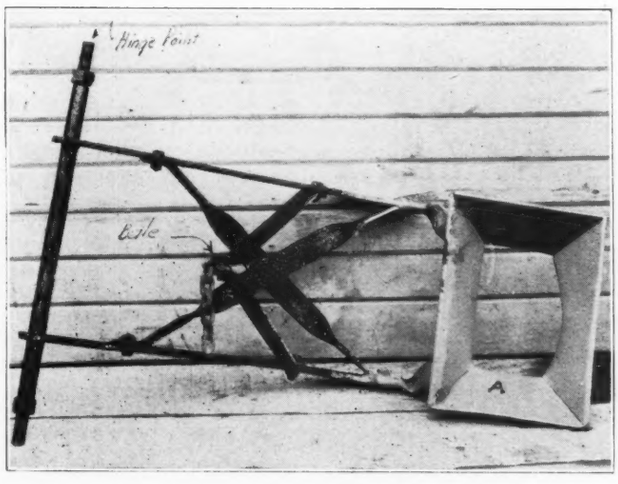


Fig. 3. This receptacle "A" is placed in the orbit of the buckets inside the drum. Dry mixtures pile up, increasing weight; wet mixtures flow through more freely, weighing less. Weight variations expressed as pressure variations are shown in the graph in Fig. 4.

Cements are known to vary in mechanical "handleability" even though almost identical in terms of general quality.

The rich mixtures become mixed more readily than the lean, and wet mixes reach the mixed condition more quickly than dry mixes. It is seen, then, that any variation in cement content or consistency sets up a new set of conditions. These two variables can not be composed by a flat reference to the water-cement ratio, because it is possible to have a water-cement ratio of, say, 0.75 with a 1-in. slump and also with a 10-in. slump. The batch with the 10-in. slump will become mixed in less than half the time necessary to mix the former. This will be obvious to anyone who has done any hand mixing.

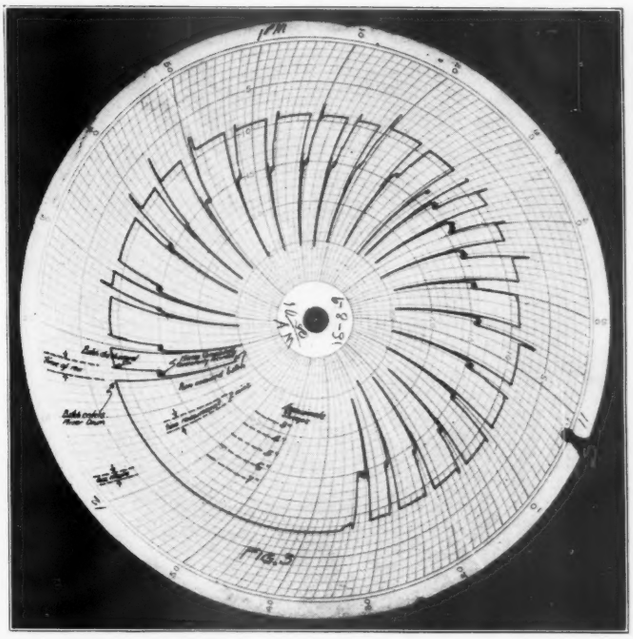


Fig. 4. Chart showing variations in consistency of concrete while being mixed.

The rate of water feed, while perhaps of secondary importance, should not be overlooked. The faster the water feed (within reason), the more quickly mixing is accomplished, and, curiously enough, the less water needed to acquire a given consistency. The writer hesitates to suggest the reason for this effect, but is prepared to demonstrate the existence of it.

The maximum size of coarse aggregate affects the mixing time in two ways: (1) the larger particles impart a better mixing by their tumbling action and impacts; and (2) the coarser the grading, the less the particle surface area, which, in effect, creates a richer mix with a given cement content and, as such, hastens mixing.

The general practice of specifying a fixed mixing time for all mixtures, consistencies, and types and sizes of mixers is much better than no specification at all, but it is to be hoped that some day a more rational rule will be developed. The writer ventures to suggest the following: Mix 13 sec. for each

aggregate part, less 3 sec. for each 1 in. of slump (with a minimum of 1 min.).

Example A (1-2-4)
Less 7-in. slump
6 parts aggregate × 13 sec. = 78 sec.
7-in. × 3 sec. = 21 sec.
57 sec.
(Use minimum 1 min.)

Example B (1-3-7)
Less 2-in. slump
10 parts aggregate × 13 sec. = 130 sec.
2-in. × 3 sec. = 6 sec.
124 sec.

Example C (1-1-2)
Less 7-in. slump
3 parts aggregate × 13 sec. = 39 sec.
7-in. × 3 sec. = 21 sec.
18 sec.
(Use minimum 1 min.)

The effect of the size and type of mixer upon the mixing time, if generally understood by those writing specifications, must have been regarded as a "political" subject best not disturbed. (Perhaps reference to it even here is unwise.) Field mixers are divided into two general groups, tilting and non-tilting, differentiated chiefly by the methods of discharge.

The non-tilting type originally used a cascading action to elevate materials by buckets for discharge by a chute. This type is necessary on pavers. It was found, incidentally, that this cascading action provided a very thorough mixing. In cascading mixers efficiency varies with the bucket size, drum speed, and drum diameter. The larger the bucket, the more "trips" made by the complete batch in a given time. The drum time should be as fast as possible, provided the bucket loads do not tend to "carry through." For this reason dry mixes should be mixed at somewhat slower drum speeds than wet. (Some day some enterprising manufacturer will develop a variable-drum-speed mechanism.) The size of the drum bears an important relation to its mixing efficiency. The larger drums provide much greater fall of the streams from the bucket crests, resulting in more thorough mixing.

The tilting type was probably first developed for concrete having oversize aggregate, such as the 6-in. or 8-in. cobbles frequently used in mass-dam construction. It was thought impractical to cascade such large aggregate into a chute. Since no buckets were needed for the act of discharging a tilter, only "fins" or "throw-over" blades were provided. These were innocent-looking things set at various angles and spacings and, perhaps, of indifferent effectiveness. It should be remembered that such machines were more efficient with the oversize aggregate because the cobbles aided mixing by their tumbling action.

It is noted that present-day "tilters" have interiors more similar to the bucket design of the cascading machines, and that the large cascading machines are now built to mix oversize aggregates without difficulty. Anyone familiar with the 3½-cu. ft. "tilter" of the vintage used by Abrams in 1917 will understand why he got a strength increase at 10 min. mixing, but to associate these findings with modern equipment is a long jump at faulty conclusions.

The writer would make the concluding comment that the compressive strength increase reported by the author is not as important as the companionate virtue of shrinkage reduction generally found in pre-mixed concrete. This effect is more readily appreciated in flexural tests than compressive, and is of real value in many superstructural uses where plastic shrinkage is an annoyance.

Fig. 4 is a typical Mixometer chart taken from the operation of 56S Rex mixers in Tru-Mix plants of the Pioneer Sand & Gravel Co. of Seattle.

Since writing this discussion, the writer has learned with deep regret of the death of Prof. Slater. If these comments are of interest, may they be considered as dedicatory to, rather than contradictory of, the work of this distinguished and respected engineer.

Coöperation or Competition in the Ready-Mixed Industry?

(*Continued from page 30*)

at the entrance to the yard. There he is given instructions and he immediately proceeds to the aggregate batchers. After a load is taken on, the truck is driven to the cement station where cement is received, and water put into the tank. The whole loading process requires about 2 min. The average length of haul is approximately 3 mi.

A remarkable performance record has been achieved by the truck-mixers and the trucks for service and economy of operation. During a continuous run of 40 hr. the entire fleet required no attention other than refueling. The service bill for five units in operation 1½ yr. and five units in operation 7 mo. was only $94.20.

All the concrete produced by the Superior company is batched according to the technical supervision of James A. Myron, who is retained by the company as consulting engineer. The Nutting Laboratory of Cincinnati is engaged for all concrete testing, and samples for every job are taken to show the customer the 7-day and 28-day strength figures.

The company's operating organization consists of a truck superintendent, a truck dispatcher and a plant-inspector who is held responsible for the accuracy of all operations. In addition there are a cement man, an elevator man, and two batching men.

Some idea of the rapidity with which concrete can be batched and delivered by the Superior Ready Mixed Concrete Co. can be gained from the fact that a single contract, calling for the delivery of 1,500 cu.yd. of concrete in 24 hr., was handled in clock-work fashion with time to spare. Not only that but a 900-cu.yd. contract, calling for delivery to five different locations, was handled within 12 hr.

Crushed-Stone Production in the Ranger Oil Field in Central Texas*

Methods and Costs at Tiffin Quarry of The Thurber Earthen Products Company

By DAYTON C. BOLIN

Chemical Engineer, Texas-Pacific Coal and Oil Co.

THE activity in the Ranger oil field of Eastland and Stephens Counties in Texas during 1918-19 created a demand for large quantities of crushed stone for highway construction, and at the same time it was felt that the railroads would soon require ballast as part of an extension program to take care of the increase in business due to the oil discovery.

Some of the directors of the Texas Pacific Coal & Oil Co., the discoverer of the new oil field, saw attractive possibilities in the crushed-stone business, provided suitable rock could be obtained locally. Limestone was known to occur throughout the locality and one or two small quarries were operating, but no comprehensive investigation of limestone resources had been made. Such a survey was undertaken and as a result a suitable ledge of limestone was found near Ranger at a place then known as Bull Creek, but later called Tiffin when it became a station on the Texas & Pacific Railway. A company known as the Thurber Earthen Products Co. was organized to produce and sell crushed limestone.

Early in 1919 the building of a modern crushing plant and the opening of the quarry were begun. The plant started operation in September, 1920. The railroads soon became active buyers of the crushed stone and the anticipated output was readily realized. Numerous improvements in plant and organization have been made from time to time.

The rock quarried at Tiffin is a limestone containing about 52 per cent. lime (CaO), largely in the form of carbonate. The overburden, which is a clayey soil varying in color from a light yellow to reddish or black, averages not more than a foot to 16 in. in depth over the whole quarry area. The limestone varies from 20 to 25 ft. in thickness,—the average being about 23 ft. Below the limestone is a layer of shale that is 12 to 18 ft. thick. The shale is supposed to cap another stratum of limestone, but there is no evidence at hand to support this supposition. The formation is fairly uniform throughout the quarry area.

Throughout the quarry, joints or seams divide the limestone into blocks with overburden or clay filling the crevices between them. In some instances these joints extend down to the shale some 25 ft. below; in other cases they run laterally, are irregular and broken, and do not extend so far. Their strike has a definite tendency to run south 30 deg. west with considerable cross-jointing at about right angles.

The limestone varies in color from a dark cream to a slate gray. This variation occurs uniformly at certain locations throughout the quarry, but the color of the stone has no material influence on its composition.

Physical tests of the stone made by the University of Texas gave results as follows:

Specific gravity	2.66	
Weight (*lb. per cu. ft.*)	166.	
Per cent. wear (*Deval test*)	2.76	
French coefficient of wear	14.50	(high)
Coefficient of hardness (*Dorry test*)	14.10	
Toughness (*Page impact test*)	7.50	(low)
Cementing value	40.0	(good)
Crushing strength on 2-in. cube, (*lb. per sq. in.*)	16,650	(high)

Chemical analyses of the quarry materials follow:

		Stone	*Shale*
Silica (SiO_2)	(*per cent.*)	2.34	80.40
Iron oxide and alumina (Fe_2O_3 & Al_2O_3)	(*per cent.*)	2.06	14.20
Lime (CaO)	(*per cent.*)	52.80	0.67
Magnesia (MgO)	(*per cent.*)	0.50	0.62
Sulphate (SO_4)	(*per cent.*)	0.15	0.63

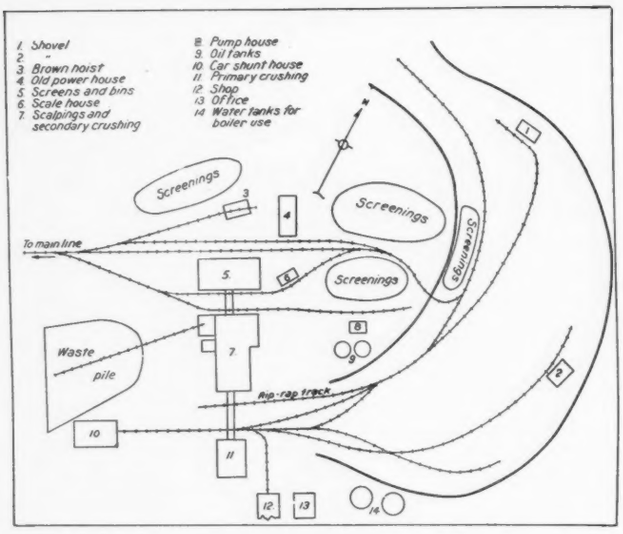
The property was tested by diamond-drill holes through the limestone at intervals of about every one hundred feet. Because of the destruction of the main office by fire many of the old drilling records are not available, but the area, formation, and content of the deposit have been well surveyed and the latter is sufficient for a considerable number of years. Cost figures for exploration are not available.

No routine sampling is carried on, and physical and chemical analyses of the limestone are made only occasionally.

Ten sizes of stone are produced ranging from 3½ in. down to 3/16 in. in maximum diameter. Screen tests of the various sizes are made in the plant and by inspectors representing large buyers. The estimated tonnage unquarried is about 8,000,000 tons, which will suffice for 25 yr. at the present rate of production.

The overburden is removed by contract in wagons and motor trucks at 40 c. per sq. yd. of surface stripped. Due to the shallow depth of the overburden, this has proved to be the least expensive method of stripping. The overburden is hauled to a valley about ½ mi. away and dumped. Contracts are given for removing a specified amount and the contractor may use his judgment in its removal so

* Reprinted from U. S. Bureau of Mines Information Circular 6531.

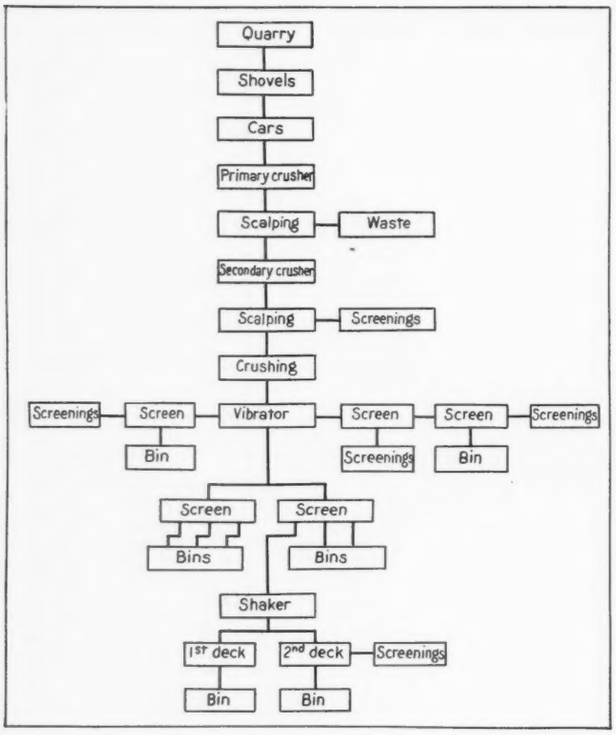


General plan of the quarry.

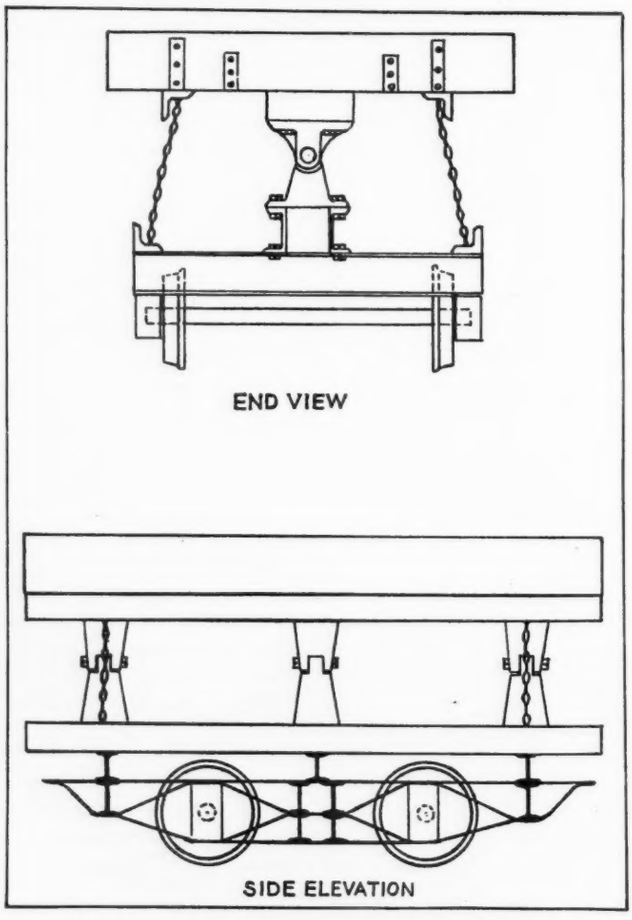
long as quarrying operations are not inconvenienced. The contractor usually completes the job as soon as possible and moves to other work until he is needed again. The overburden has no commercial value. It is dumped into the valley with the idea of eventually damming it and furnishing a reservoir for water to be used in and around the quarry.

Six-inch holes are drilled about 23 ft. deep with two portable Loomis Clipper churn-type well-drills. Power is furnished by a 50-hp., 4-cyl. Buda gasoline engine. The drilling speed is about 8 ft. per hr. per machine. The holes are spaced 10 ft. apart and 10 ft. from the bench face. About 35 holes are shot simultaneously, and as a rule three-quarters of the charge is at the bottom of the hole, the other quarter being placed further up. The position of the charge depends on the prevalence of the joints and the uniformity of the rock.

Sixty-per cent. quarry gelatin in 5-in. by 12-in. sticks is used in blasting the drill holes. No. 6 detonators, and plain and single-countered cordeau are used. The speed of the fuse, which is of the safety type, is about 1 ft. per min. No primers are used. Springing is unnecessary due to the size of the hole. The cordeau is lowered with the first cartridge, the remaining cartridges are tamped in, and the hole is filled with limestone screenings. About a foot of cordeau is left extending above ground to tie into the lead wire for firing.



Flow-sheet of the plant.

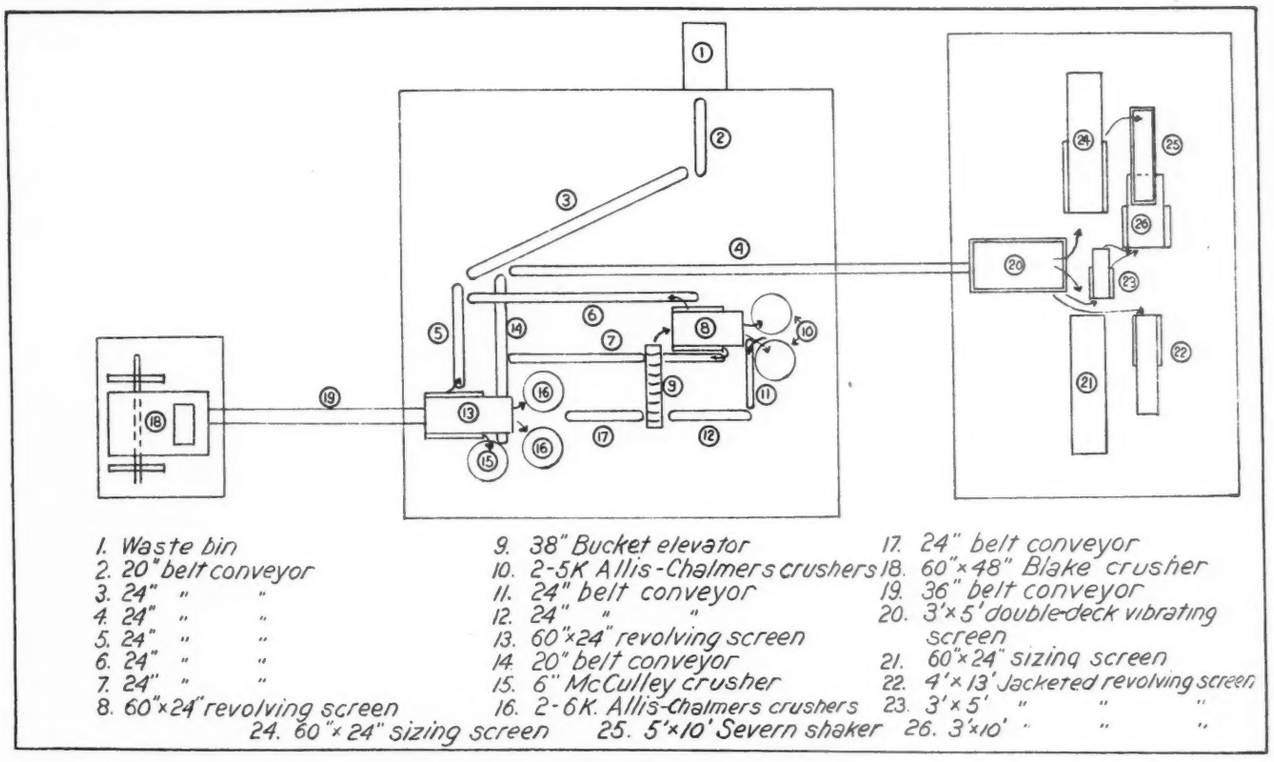


Drawing showing construction of quarry dump car.

One crew consisting of four men—powder foreman, driller and two helpers—load, tamp, and fire. The time required for loading 35 holes is approximately 4 hr. Each hole takes roughly a 75-lb. charge of explosive.

The fragmentation obtained varies from pieces of rock less than an inch in maximum diameter to 6 or 8 ft. boulders. The use of a large primary crusher reduces secondary blasting to a minimum.

The amount of secondary blasting depends to a great extent on what part of the quarry is being worked—in other words, on the extent to which joints prevail and the angle at which they approach the bench. From 10 to 20 per cent. of the stone requires secondary blasting.


1. Waste bin
2. 20" belt conveyor
3. 24" " "
4. 24" " "
5. 24" " "
6. 24" " "
7. 24" " "
8. 60"×24" revolving screen
9. 38" Bucket elevator
10. 2-5K Allis-Chalmers crushers
11. 24" belt conveyor
12. 24" " "
13. 60"×24" revolving screen
14. 20" belt conveyor
15. 6" McCulley crusher
16. 2-6K. Allis-Chalmers crushers
17. 24" belt conveyor
18. 60"×48" Blake crusher
19. 36" belt conveyor
20. 3'×5' double-deck vibrating screen
21. 60"×24" sizing screen
22. 4'×13' Jacketed revolving screen
23. 3'×5' " " "
24. 60"×24" sizing screen
25. 5'×10' Severn shaker
26. 3'×10' " " "

Plan of the crushing-and-screening plant.

Block-holing is the method used in secondary blasting, although mud-capping is resorted to at times. One and one-quarter inch holes are drilled with an Ingersoll-Rand Jackhamer. Forty-per cent. N. G. dynamite and safety fuse are employed. One hole is usually sufficient for each boulder. The secondary blasting is done by three men from the shovel crew as the work becomes necessary.

The quantity of explosive used for primary blasting averages about 75 per cent. of the total, which is approximately 1/5 lb., costing 2½ c. per ton of stone broken.

Two steam, railway-type shovels equipped with 2 and 2½ cu.yd. dippers, respectively, are used for loading. These are operated by six men to the shovel, the crew consisting of an engineer, craneman, fireman, and three pitmen. The three pitmen act as secondary-blasting men and are supervised by the engineer or quarry foreman.

The stone and the waste at the quarry are all loaded together, the separation being made in the plant. The shovels load 5 cars of 7-tons capacity each in about 7 min., or about 2,000 tons of rock per day for the two shovels. The shovels are capable of loading 3,000 tons, but the plant will not take care of this quantity.

The transportation of the stone from the quarry is taken care of by two Porter, 18-ton, saddle-type, standard-gauge steam locomotives with 4-wheel drive. These locomotives each pull 5 flat-bottom cars with upright sides and having a capacity of 7 tons each up a 3-per cent. grade to the crusher, and return them to the quarry over the same track. The haul may vary from ¼ to 1 mi., depending on where the shovels are working. The cars are delivered directly to the crusher and are side dumped into the crusher mouth. The cars are Western Wheeled Scraper type and have bodies lined with steel plate. The permanent tracks are of 75-lb. rails and the movable tracks are of 65-lb. steel. Each locomotive has one operator or engineer who does all the work—firing, taking water, lubricating cars, etc. The fuel used is a topped crude oil purchased from a nearby refinery in tank cars.

The loaded quarry cars are dumped into the primary crusher by a Curtis air hoist having an 8-in. diameter and 6-ft. stroke and exerting a 5-ton lift with 80 lb. of air pressure. The air compressor is a belt-driven compressor having a 10-in. by 10-in. cylinder and making 275 r.p.m.

The cars are spotted above the crusher by the locomotives and are lowered to the crusher for dumping by a cable attached to the upper car and running off a drum controlled by an air-pressure clutch. The cable is rewound on the drum by a 50-hp. squirrel-cage motor. This mechanism was made locally and, although not of the best, it answers its purpose satisfactorily.

After being discharged into the primary crusher the stone takes the following route:

1. 60-in. by 48-in. Blake jaw crusher.
2. 36-in. conveyor belt.
3. 60-in. by 24-ft. Allis-Chalmers revolving scalping screen.
4. 24-in. conveyor belt.
5. Two No. 6K Allis-Chalmers gyratory crushers.
6. 6-in. McCully gyratory crusher.
7. 20-in. conveyor belt.
8. 24-in. conveyor belt.
9. 38-in. bucket elevator.

10. 60-in. by 24-ft. Allis-Chalmers revolving scalping screen.
11. Two No. 5K Allis-Chalmers gyratory crushers.
12. 24-in. conveyor belt.
13. 24-in. conveyor belt.
14. 36-in. by 5-ft. vibrating screen.
15. Two 60-in. by 24-ft. sizing screens.
16. Screens for sizing small materials.
17. Storage bins.

The primary breaker is a 60-in. by 48-in. Blake-type jaw crusher. It is set with a discharge opening of 8 in. and is driven by a 200-hp. induction motor. Electric power is now furnished by transmission lines from the Eastland plant of the Texas Electric Service Corp. The size of stone fed ranges from a fraction of an inch up to the largest size the crusher will take.

The discharge from the primary crusher which varies in size from less than 1 in. to 8 in. in diameter is carried by a 36-in. rubber-covered conveyor belt a distance of 142 ft. The conveyor is driven by belt from a main line shaft which serves other conveyors, revolving screens, and crushers, and which is driven by a 150-hp. induction motor.

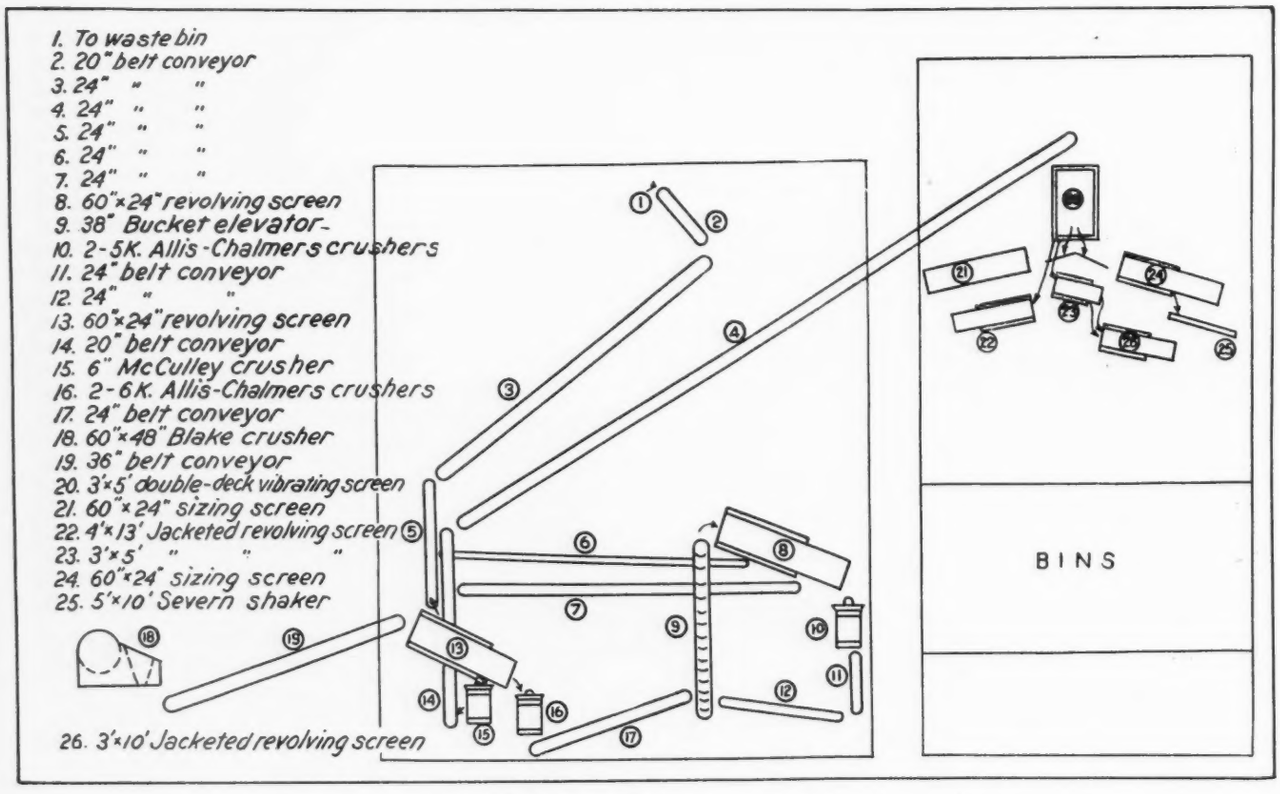
The 60-in. by 24-ft. Allis-Chalmers revolving screen is fed from the primary crusher by the 30-in. belt conveyor. It has round perforations ranging from 3½ to 2 in. in diameter, and is jacketed two-thirds of its length with a ⅝-in. square-mesh screen. Material that passes the jacket goes to waste and that retained on the ⅝-in. screen goes to the 6-in. McCully crusher with the coarse material from the screen. During wet weather, however, all stone through the 2-in. screen goes to waste to eliminate the dirt, clay, etc., that does not pulverize due to the dampness. The power for the screen is delivered from the same line shaft that drives the 30-in. conveyor from the primary crusher.

A 24-in. rubber-belt conveyor takes the waste material from the first scalping screen and also the ⅜-in. screenings from the second scalping screen when there is no demand for this class of material. The ⅜-in. screenings when salable are stored in bins. This conveyor is 160 ft. long and is belt-driven by a 10-hp. induction motor.

There are two No. 6K Allis-Chalmers gyratory crushers fed by gravity from the revolving screen. The discharge of each crusher has an opening of 3½ in. from which the stone is delivered directly to a 24-in. belt conveyor. The drive is from the main line-shaft by belt. A 6-in. McCully crusher is fed from the scalper, receiving the 3½ to 2 in. oversize. The discharge opening is 2¼ in. and the crusher is driven by belt from the main line shaft. A 20-in. rubber-belt conveyor receives the discharge from the McCully 6-in. crusher. It is 40 ft. long and discharges onto the 24-in. conveyor carrying the crushed stone to the sizing screens. It is driven by a 7½-hp. Allis-Chalmers motor.

The discharge from the 6K Allis-Chalmers crusher is handled by a 24-in. rubber-belt conveyor, 20 ft. long, driven by a 7½-hp. motor. It discharges to a bucket elevator.

This elevator is 40 ft. high and carries 38-in. buckets. It elevates the crushed material from the 6K Allis-Chalmers crusher conveyor to the second scalping screens, and has a slope of about 60 deg.


1. To waste bin
2. 20" belt conveyor
3. 24" " "
4. 24" " "
5. 24" " "
6. 24" " "
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9. 38" Bucket elevator
10. 2-5K. Allis-Chalmers crushers
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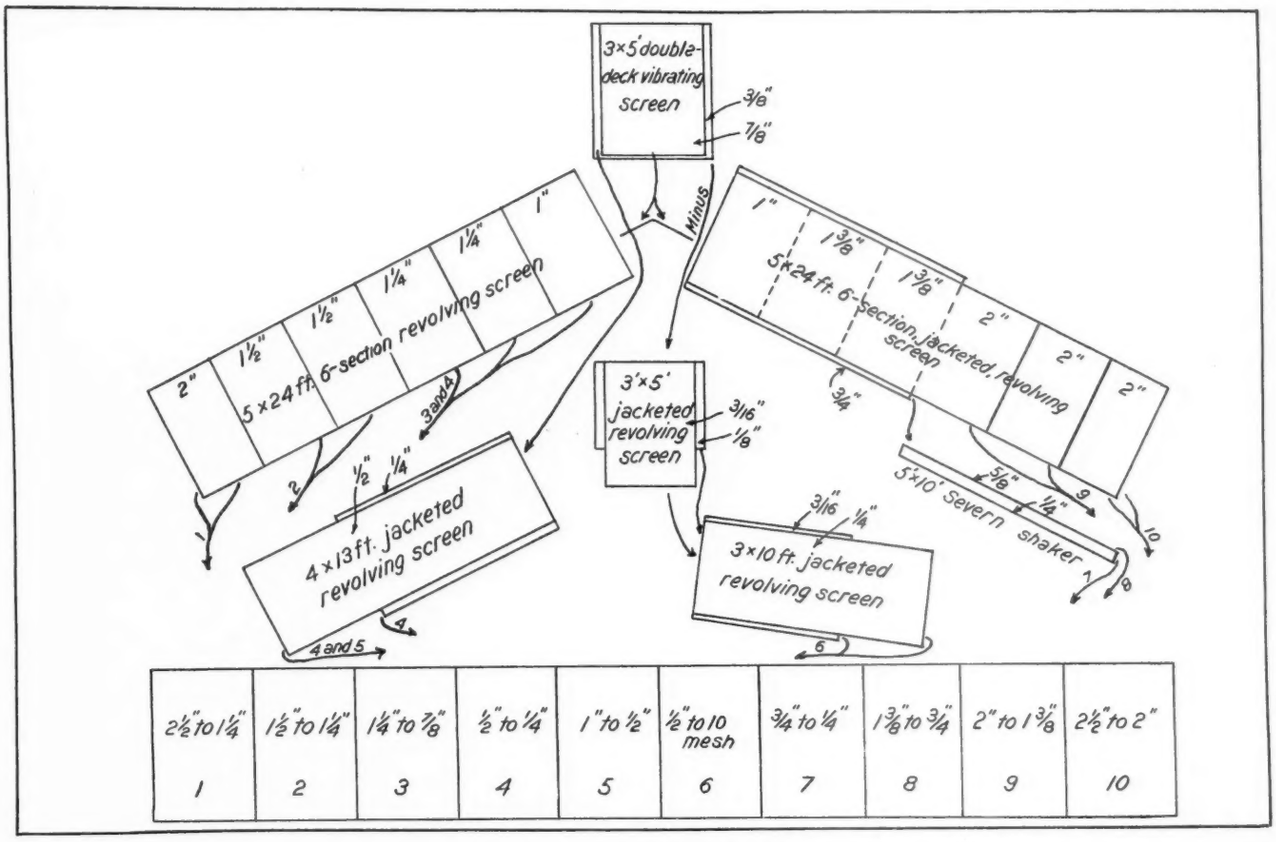
23. 3'×5' " " "
24. 60"×24" sizing screen
25. 5'×10' Severn shaker
26. 3'×10' Jacketed revolving screen
BINS

Elevation of the crushing-and-screening plant.



Sizing screens and details of bins.

The elevator is belt-driven from the main line-shaft through reduction gears to obtain the desired speed.

The second scalper is a 60-in. by 24-ft. Allis-Chalmers revolving screen having five sections, four sections with 2-in. perforations and one section with 2½-in. perforations. The four sections with 2-in. holes are jacketed with ⅝-in. mesh screen. The screenings go to either the waste bin or the screenings bin, depending on market conditions. The material retained on the ⅝-in. screen goes to the sizing screen via the 24-in. conveyor along with other materials for the same destination. The stone retained on the scalping screen is discharged by gravity directly into two 5K Allis-Chalmers crushers. The scalping screen is powered from the main-line shaft.

There are two 5K Allis-Chalmers gyratory crushers that receive the stone from the second scalping screen. Their discharge openings are set at 2¼ in. The discharge from the crushers is returned to the 38-in. bucket elevator by two 24-in. conveyors and thence to the second scalping screen, thus forming a closed circuit. Power for these crushers is supplied from the main-line shaft by belt drive.

A 24-in. belt conveyor takes the discharge from the two 5K Allis-Chalmers crushers and delivers it to another 24-in. belt conveyor traveling at right angles, which carries the material to the 38-in. bucket elevator and then to the second scalping screen. The conveyors are driven by a 7½-hp. motor.

The screenings from the second scalping screen are handled by a 24-in. belt conveyor 60 ft. long that can discharge all or part of the material to either the conveyor going to the sizing screen or to the waste bin, depending on the demand for material of this size. The conveyor is driven by a 10-hp. motor.

The crushed material for the sizing screens is delivered by a 24-in. rubber-belt conveyor to a 3-ft. by 5-ft. Link Belt, double-deck, vibrating screen, having an upper deck of ⅞-in. sq. mesh and a lower deck of ⅜-in.-mesh screen. The undersize through the ⅞-in. screen goes to the ⅜-in. screen and the oversize on the ⅜-in. screen is discharged through a chute to a smaller revolving screen for further separation and cleaning from dust. The undersize from the ⅜-in. screen also goes to a revolving screen for further separation. The oversize on the ⅞-in. screen is discharged, split, and fed to the revolving sizing screens. The vibrating screen is belt-driven by a 7½-hp. motor.

Two 60-in. by 24-ft. Allis-Chalmers sizing screens

TABLE I—PRODUCTS OBTAINED FROM CRUSHED STONE

Product	Tons per 2,000 tons stone	Percentage of total
Minus 2½ plus 2 in.	770	38.5
Minus 2 plus 1¾ in.	110	5.5
Minus 1½ plus 1 in.	80	4.0
Minus 1¾ plus ¾ in.	150	7.5
Minus 1¼ plus 1 in.	170	8.5
Minus 1 plus ½ in.	70	3.5
Minus ¾ plus ⅝ in.	50	2.5
Minus ¾ plus ¼ in.	50	2.5
Minus ⅝ plus ¼ in.	30	1.5
Minus ½ plus 10 mesh	20	1.0
Commercial stone	1,500	75.0
Waste	500	25.0
Total	2,000	100.0

receive the oversize from the upper deck of the Link-Belt vibrating screen. There are six sections in each screen with perforations varying from 1 in. to 2 in. The sized stone is chuted to storage bins. These two large sizing screens, together with three small revolving screens in the screen room, are driven from a line shaft by a 100-hp. induction motor.

The east screen has a ¾-in.-square mesh jacket for 12 ft. of its length. Each of the six sections of both the east and west screens is 4 ft. long and has round holes.

The undersize from the first three sections of the east screen discharges into the jacket and is taken care of as described later. Sections 4 and 5 supply the same bin. The undersize from section 6 and the overall rejects go to a separate bin and range from about 2-in. up to whatever size is demanded, the maximum size being regulated by the setting of the crusher, which is usually 1½ in.

The undersize from the first three sections of the west screen go to the same stone bin, and the combined product is classified as 1¼ over ⅞ in. The undersize of the fourth and fifth sections supply 1½ over 1-in. stone. Section 6 turns out the same products as section 6 of the east screen.

There are four fine screens—three revolving and one vibrating—that further separate the small material coming from the two large sizing screens.

The undersize from the lower deck, ⅜-in. mesh, of the vibrating screen is received by a 3-ft. by 5-ft. jacketed revolving screen. The inside drum has 3/16-in.-square mesh and the jacket has ⅛-in.-square mesh. The undersize from the ⅛-in. screen goes to the dust bin, and the material retained on both the ⅛ and 3/16 in. screen is discharged into a 3-ft. by 10-ft. jacketed revolving screen with an inside screen of ¼-in. mesh and with a 3/16-in.-mesh jacket. These further eliminate the dust. The undersize from both the inside screen and jacket go to the same bin as a commercial minus ½ in., plus 10-mesh product.

TABLE II—SUMMARY OF COSTS TIFFIN QUARRY (1929)

Total overburden stripped	7,700 cu. yd.
Total stone mined	443,325 tons
Crushed and sold	308,571 tons
Waste, screenings, and loss	134,754 tons

	Amount	Per-ton Costs	
		Based on 443,325 tons mined	Based on 308,571 tons sold
Stripping (contract) and rental of land	$11,924.20	$0.0269	$0.0387
Drilling and blasting[1]	27,063.50	.0610	.0877
Shovel and loading[2]	39,717.20	.0896	.1287
Total cost of rock loaded in quarry cars	78,704.90	0.1775	0.2551
Transportation to jaw crusher[3]	16,484.82	.0372	.0534
Jaw-crusher expense[4]	9,797.20	.0221	.0318
Secondary crushing and screening	27,312.37	.0616	.0885
Waste disposal	4,611.22	.0104	.0149
Loading and switching	14,497.49	.0327	.0470
Superintendence and general plant expense	13,096.34	.0295	.0424
Total operating costs	164,504.34	0.3710	0.5331

[1] Includes all expenditures for primary and secondary drilling and blasting before shovel operations.
[2] Includes cost of some explosives used during shovel operations.
[3] Includes maintenance of locomotive, cars and tracks.
[4] Includes cost of some pop shots at crusher.

The undersize from the ⅜-in. vibrating screen discharges into a 4 ft. by 13 ft. jacketed revolving screen. The inside screen is ½-in.-square mesh and the jacket is ¼-in.-square mesh. The undersize from the ¼-in. screen goes to the dust bin and the oversize goes to a bin as a minus-½, plus-¼ mesh product.

One of the large sizing screens has a ¾-in.-mesh jacket for 12 ft. of its length. The undersize from this jacket is discharged to a 5-ft. by 10-ft., double-deck Severns shaker screen that is driven by a 10-hp. motor. The upper deck has ⅝-in. round perforations and the lower deck ¼-in. perforations. The undersize from the ¼-in. deck goes to the dust bin, and the oversize is delivered to the minus-⅝, plus-¼-in. commercial bin. The oversize from the ⅝-in. deck goes to the minus-¾, plus-⅝-in. bin.

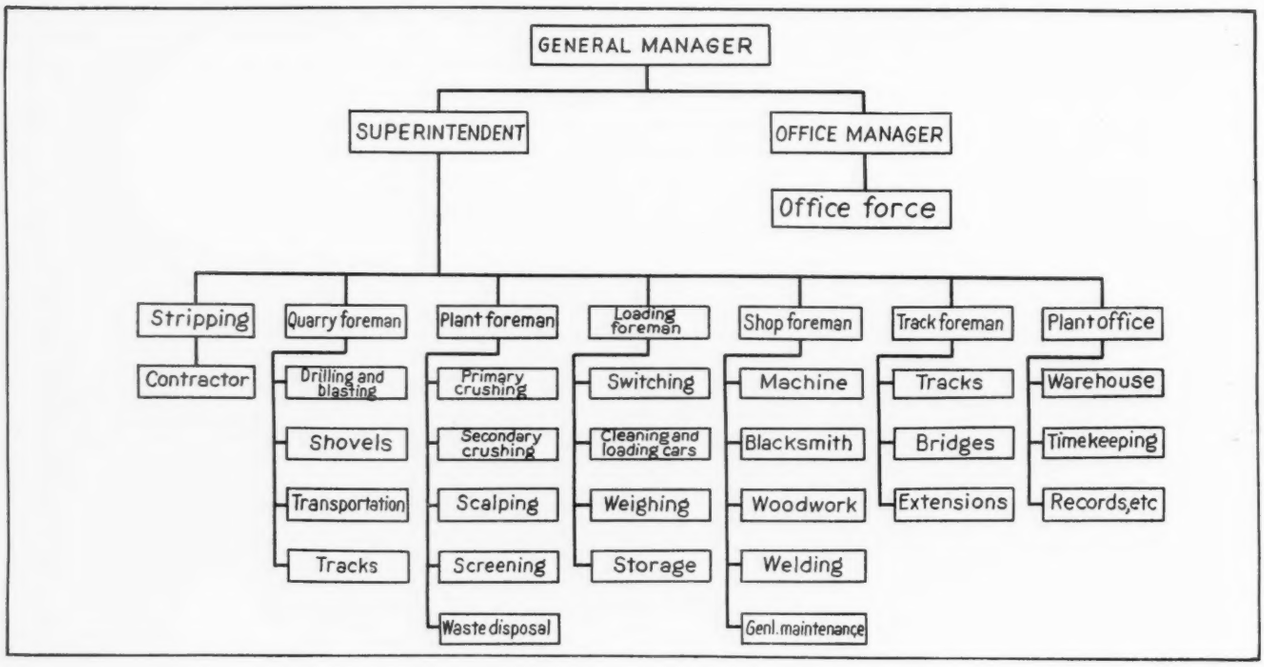


Chart showing organization of the quarry personnel.

The oversize from the large sizing-screen jacket is directed into the minus-1⅜, plus-¾-in. commercial bin. When specifications do not exact a thorough separation the various sizes from 1⅜-in. down to ¼-in. can be and sometimes are delivered to the same bin and considered as minus-1⅜, plus-¼-in. commercial stone.

The output consists of ten sizes of material. The products obtained from 2,000 tons of crushed stone are shown in Table I.

The bins are so arranged that the various materials may be mixed to accommodate demands for any specific size or range of sizes. Their contents can be drawn off separately by gates leading directly through chutes into cars. One man handles all the loading. A separate building houses the primary crusher. This is a small, wood-frame structure covered with corrugated iron, having 1,500 sq. ft. of ground area and 37,500 cu. ft. volume. The secondary-crushing and scalping-screen building has 7,200 sq. ft. of floor space and a volume of 360,000 cu. ft. This building also has a wooden frame with corrugated-iron sides and roof, and concrete foundations. The screen and bin house has 8,800 sq. ft. of floor area and a volume of 570,000 cu. ft. The three buildings are connected by conveyor sheds which are constructed of the same materials as the buildings and which rest on concrete foundations.

TABLE III—DETAILED COST—DIRECT OPERATIONS (1929)

	Amount	Costs per Ton	
		Based on 443,325 tons mined	Based on 308,571 tons sold
Stripping Expense:			
Let by contract	$8,924.20	$0.0201	$0.0289
Royalty to landowners	3,000.00	.0068	.0098
Total stripping	11,924.20	0.0269	0.0387
Drilling and Blasting:			
Operating labor	5,849.48	.0132	.0190
Fuel (gasoline)	1,886.70	.0043	.0061
Water	117.00	.0002	.0004
Lubricants and supplies	90.65	.0002	.0003
Repair labor and material	2,465.89	.0056	.0080
Explosives	16,653.78	.0375	.0539
Total drilling and blasting	27,063.50	0.0610	0.0877
Shovel and Loading Expense:			
Operating labor	13,424.36	.0303	.0435
Gas (natural)	5,076.97	.0115	.0164
Power	417.00	.0009	.0014
Water	654.44	.0015	.0021
Lubricants and supplies	986.98	.0022	.0032
Maintenance of shovels	10,556.98	.0238	.0342
Maintenance of lines	1,242.90	.0028	.0040
Changing shovel tracks	2,798.16	.0063	.0091
Explosives (secondary)	4,559.41	.0103	.0148
Tota' shovel and loading expense	39,717.20	0.0896	0.1287
Tansportation Expense: (From quarry to jaw crusher)			
Operating labor	3,892.21	.0088	.0126
Fuel oil	3,504.70	.0079	.0114
Gas	526.80	.0012	.0017
Water	337.33	.0008	.0011
Lubricants and supplies	243.01	.0005	.0008
Maintenance locomotives	2,525.90	.0057	.0082
Maintenance dump cars	3,110.24	.0070	.0100
Maintenance tracks	2,344.63	.0053	.0076
Total transportation	16,484.82	0.0372	0.0534
Jaw Crusher:			
Operating labor	2,731.54	0.0062	0.0089
Power	1,749.86	.0039	.0057
Water	112.00	.0003	.0004
Lubricants and supplies	717.99	.0016	.0023
Maintenance machinery	3,886.78	.0087	.0125
Maintenance buildings	112.76	.0003	.0004
Explosives (pop shots)	486.27	.0011	.0016
Total crusher	9,797.20	0.0221	0.0318
Secondary Crushing and Screening Expense:			
Operating labor	8,935.62	.0202	.0290
Power	9,733.22	.0219	.0315
Lubricants and supplies	991.42	.0022	.0032
Maintenance machinery	7,481.49	.0169	.0242
Maintenance buildings	170.62	.0004	.0006
Total secondary crushing and screening	27,312.37	0.0616	0.0885
Waste Disposal: (Screenings, clay, etc.)			
Operating labor	2,274.65	0.0052	0.0074
Fuel oil	495.50	.0011	.0016
Power	841.80	.0019	.0027
Lubricants and supplies	51.55	.0001	.0002
Maintenance of equipment	947.72	.0021	.0030
Total waste disposal	4,611.22	0.0104	0.0149
Loading and Switching Expense:			
Operating labor	5,639.79	.0127	.0183
Fuel oil	2,496.33	.0056	.0081
Gas	258.35	.0006	.0008
Water	337.35	.0008	.0011
Lubricants and supplies	182.50	.0004	.0006
Maintenance locomotives	2,425.19	.0055	.0079
Maintenance storage bins	340.20	.0008	.0011
Maintenance tracks and scales	2,817.78	.0063	.0091
Total loading and switching	14,497.49	0.0327	0.0470

No storage facilities are provided other than the bins, but the quarry floor is excellently suited for storage. All waste is stored or dumped near the plant and is transported from the waste bins by rail in 2-cu.yd., side-dump, steel cars. The haulage is done by an electric mining-hoist engine, using a ¾-in. steel cable and a 100-hp. induction motor. Disposal of the waste and screenings is also accomplished by means of a Brownhoist locomotive crane. The material is loaded into regular railway-type cars from the bin and hauled to the point of unloading where the crane discharges the cars. The crane carries a 1-cu.yd. clamshell bucket and a 40-ft. boom. About 40 minutes is required to unload a 50-ton car.

The general yard haulage is done by a 50-ton, saddle-type, 4-wheel-drive American locomotive. The main duty of this locomotive is to haul the empty and loaded cars to and from the main-line switch of the Texas and Pacific Railroad at Tiffin, which is about ¾ mi. distant. All hauling of screenings, waste, rip-rap, etc., is also done by this locomotive. The loading yard has accommodations for the storage of 65 cars. There are approximately 7 miles of track inside the quarry. The stone is weighed on a 150-ton Howe scale by the loader, who is a certified weigher. The car loader has an assistant who cleans and patches the cars to prevent waste in transit.

Compressed air is used for secondary drilling, drill sharpening, lowering and spotting quarry dump cars at the primary crusher, blowing and cleaning motors, pneumatic tools, etc. The main air supply is obtained from a 10-in. by 10-in. Ingersoll-Rand compressor, making 275 r.p.m. and delivering air at 100-lb. pressure. In addition there are two 11-in. by 12-in. locomotive-type Westinghouse air-brake compressors mounted on the two steam shovels, which supply air for secondary drilling.

All the shop work is done in one building. Most parts are ordered in the rough and machined down to requirements, especially such parts as bushings, shafting, collars, axles, pistons, piston rings, drill stems, bearings, and such other materials as can be handled similarly.

Due to the rather isolated location of the quarry this well-equipped shop pays for itself. The personnel of the shop consists of one shop foreman, a

TABLE IV—SUMMARY OF COSTS PER TON (1929)

Operating Account	Labor		Fuel and Gas		Water		Lubricants and Supplies		Maintenance		Explosives		Power		Total	
	Per ton mined	Per ton sold	Per ton mined	Per ton sold	Per ton mined	Per ton sold	Per ton mined	Per ton sold	Per ton mined	Per ton sold	Per ton mined	Per ton sold	Per ton mined	Per ton sold	Per ton mined	Per ton sold
Stripping by contract and rental															$0.0269	$0.0387
Drilling and blasting	$0.0132	$0.0190	$0.0043	$0.0061	$0.0002	$0.0004	$0.0002	$0.0003	$0.0056	$0.0080	$0.0375	$0.0539			.0610	.0877
Shovel and loading	.0303	.0435	.0115	.0164	.0015	.0021	.0022	.0032	.0329	.0473	.0103	.0148	$0.0009	$0.0014	.0896	.1287
Cost of rock f.o.b. quarry cars	.0435	.0625	.0158	.0225	.0017	.0025	.0024	.0035	.0385	.0553	.0478	.0687	.0009	.0014	.1775	.2551
Transportation	.0088	.0126	.0091	.0131	.0008	.0011	.0005	.0008	.0180	.0258					.0372	.0534
Jaw crusher	.0062	.0089			.0003	.0004	.0016	.0023	.0090	.0129	.0011	.0016	.0039	.0057	.0221	.0318
Secondary crushing and screening	.0202	.0290					.0022	.0032	.0173	.0248			.0219	.0315	.0616	.0885
Waste disposal	.0052	.0074	.0011	.0016			.0001	.0002	.0021	.0030			.0019	.0027	.0104	.0149
Loading and switching	.0127	.0183	.0062	.0089	.0008	.0011	.0004	.0006	.0126	.0181					.0327	.0470
Superintendence and plant miscellaneous															.0295	.0424
Total	0.0966	0.1387	0.0322	0.0461	0.0036	0.0051	0.0072	0.0106	0.0975	0.1399	0.0489	0.0703	0.0286	0.0413	0.3710	0.5331

machinist, a blacksmith, a blacksmith's helper, a welder, and a carpenter.

Originally the plant had its own power plant, consisting of two 250-hp. Casey-Hedges boilers driving a turbo-generator, which developed a maximum of 625 kw. with a power-factor of 80 per cent. at 3,600 r.p.m. Since 1923 all power has been purchased from the Texas Electric Service Co. Power costs are distributed on the basis of rated horsepower and the hours worked by each motor.

One 2½ by 2-in., 4-stage, type-V, house-fitted, horizontal centrifugal pump, driven directly by a 30-hp., 3,500-r.p.m., Allis-Chamers, squirrel-cage motor, supplies water under pressure to the entire plant. A steam pump is used for unloading oil from tank cars to storage tanks and for pumping oil from the storage tank to the locomotives and crane. This pump is run by steam from a 20-hp. upright boiler which is also utilized in cold weather for pre-heating fuel oil.

There are two fuel-oil storage tanks, with 8,000-gal. capacity each, which hold fuel for the locomotives and the crane. The shovel boilers and stationary boilers are fired with natural gas from the near-by gas fields through temporary pipe lines. The water supply comes from a privately-owned lake. Before use in the boilers the water is chemically treated in a 1,600-bbl. tank to prevent priming and scaling, and after settling is drawn off into another 1,600-bbl. tank for direct transfer to the various boilers.

The dynamite is stored in a concrete-and-steel cellar about ½ mile from the quarry and is brought to the job by truck.

Superintendence includes the salary of the superintendent, quarry foreman, night watchman, clerks, general supervision and office work, and all expense in connection with the safety program. The office and warehouse expense includes the cost of materials, supplies, and maintenance of equipment for this particular department. The general-buildings expense includes the cost of upkeep of camp dwellings, dynamite house, water and oil storage tanks, office and warehouse buildings, oil-and-paint storage house, change house, etc. Miscellaneous expense includes all general expenses that can not be definitely allocated, such as that for yard cleaning, janitor work, etc.

After an employee has been with the company for one month he is eligible for a group life policy, the principal of which increases with length of service from $200 to a maximum of $1,000, depending upon the length of service. The premiums are paid by the company.

All employees are paid twice a month on an hourly basis. The superintendent, quarry foreman, watchman, and clerk, however, are paid a monthly salary. During a year the quarry is operated about 275 days of 10 hr. each, or an average of 53 hr. per week. The average hourly wage is 47 c.

The only contract work is the removal of overburden, as previously mentioned. No bonus system is in force.

Steps were taken in 1926 to inaugurate a safety program. A general safety committee, consisting of senior members of the company, and a safety council committee at the plant, including the superintendent, quarry foreman, and the foreman of each department, were organized. Meetings are held monthly, at which time reports are read and discussed, and means of preventing accidents are considered.

Before a new employee is placed on the payroll, he is examined by the company's physician and directed to read a pamphlet of instructions on safety methods. On the employees' application blank he is required to give in detail his past record for several years. After employment he is especially coached in his duties with a view toward safety and he is supposed to attend safety meetings.

The frequency rates of accidents for the past three years are: 1928, 78.5; 1929, 56.0; 1930, 32.0.

The superintendent is in charge of all operations and he appoints foremen and other department heads after consultation with the vice-president. The superintendent is aided by an assistant, who is the quarry foreman.

Due to unavoidable circumstances PIT AND QUARRY is forced to omit, in this issue, the usual article on the nonmetallic-mineral resources of one of the various states. The series will, however, be resumed in an early issue.

The Lubrication of Equipment Employed in the Pit and Quarry Industry

By EDMUND S. GLAUCH
Mechanical Engineer, Joseph Dixon Crucible Co.

WITHIN the past few years lubrication has become a more important factor in the operation of all types of machinery and equipment. Without proper lubrication present-day high speeds would not be possible nor would equipment function for long periods without shut-downs for overhauling.

In earlier slow-moving machines lubrication was not seriously considered by designers and builders. Oil holes would be provided and bearings would be grooved, but, in some cases, grooving would be such as to lead the oil away from the very section of the bearing where it was most required. Fig. 1 shows incorrect method of grooving the bottom half of a horizontal bearing. Sharp edges, as indicated, will have a tendency to break the oil film and retard its entrance into the bearing where it is required. Then, too, the cross grooves will lead the oil away from the pressure area. Fig. 2 shows a correct form of grooving for the bottom half of a horizontal bearing. For average loads the chamfers, as shown, will be all that is necessary to create the oil wedge in the bearing. If a bearing is to operate under heavy load or at slow speeds, it would be advisable to cut a straight groove, as shown by the dotted line. Sharp edges must be removed in cutting this groove, otherwise it will not improve conditions. Care must be taken not to cut the groove in the pressure area. Grooves and chamfers should not, in the average bearing, be cut any nearer to the ends of the bearing than ½ in. Should grooves be cut too close to the ends of the bearing, oil will find its way out over the ends of the bearing and excessive quantities of oil will be necessary to provide proper lubrication.

The changes in lubrication and in the method of applying lubricants have been gradual, starting with sight-feed oil-cups and compression grease-cups, and then high-pressure fittings, and circulating-oil systems for some types of machines. The most recent developments have been in high-pressure systems which are connected with the various points to be lubricated, so that the operator can lubricate all parts from one point. In some cases, on large installations, the lubricant is fed automatically at regular predetermined intervals to provide most efficient lubrication. Installations of this type also prevent accidents to employees, which sometimes occur when they are lubricating machines by hand methods.

In this article we shall discuss the lubrication of equipment used in the quarrying, handling and crushing of nonmetallic-minerals. This is a field where lubrication today is receiving more attention than formerly because lubrication is very important, due to the conditions under which machines are forced to operate. In some cases, where equipment is operated outdoors, water is often present and then the presence of abrasive dust from the material being handled is also a serious problem.

In newer machines, where ball- or roller-bearings are used, lubrication problems are simplified, as bearings of this type are completely inclosed, enabling one better to keep the lubricant in the bearing and the dust and abrasives out. Ball- and roller-bearing housings, as a rule, should not be completely filled with grease but, where abrasive dust is present, it is good practice to force sufficient new grease into the bearings so that some of the old grease is forced out around the shaft. This will tend to keep dust out of the bearings. Bearings lubricated in this manner will operate at slightly higher temperatures than if they had just the proper amount of grease in their housings. Keeping the dust out in this case, however, is more important than slight increases in temperatures.

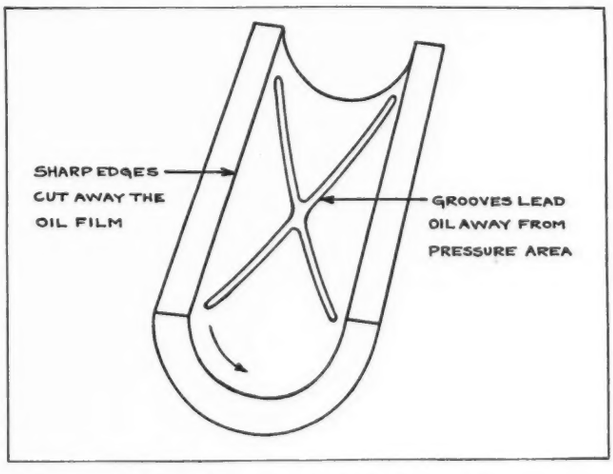


Fig. 1. Improper method of grooving.

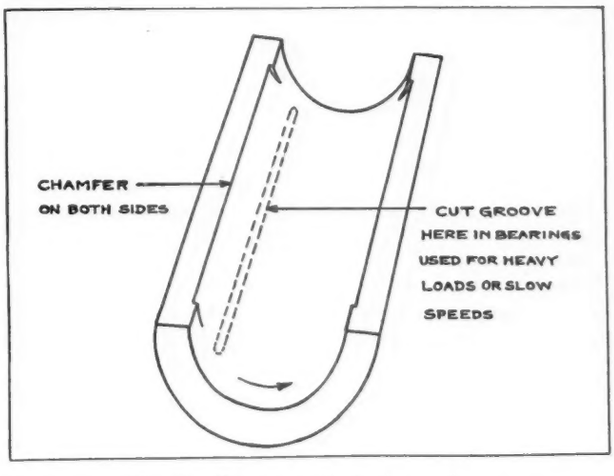


Fig. 2. Correct method of grooving.

The cheapest oils and greases, when considered from the standpoint of price per gallon or pound, are often found to be the most expensive over a period of time. Therefore, when lubricants are offered because they are cheap, they should be tested carefully before adopting them for standard practice. Cheap lubricants will often lead to higher power costs as well as higher repair bills.

The writer has made a large number of tests in another industry where heavy-duty equipment is used and has found, in some cases, that a change in lubricant would result in power savings as high as 25 per cent. The additional cost of grease in these cases was, on the average, not over 2 or 3c per lb., yet savings in power would often be many times the additional cost of the grease and, in some cases, more than the entire grease cost. It is sometimes difficult to test lubricants on machines for which they are developed and yet preliminary tests should be made before trying a new product on production equipment.

Several years ago the writer designed a special heavy-duty testing machine on which high bearing pressures could be obtained and tests could be made on a bearing large enough to make the tests practicable and comparable to actual service conditions.

This machine is shown in Fig. 3. As designed, loads and speeds can be varied to approximate those to be encountered in actual service. Should the grease be one that is to work in the presence of water, tests can be made on this machine under these conditions.

In Fig. 4 we have curves plotted from tests which were made on this machine and indicate how three greases used for similar purposes compare. Curve A was obtained by testing first-quality No. 3 cup grease. It will be noted that the coëfficient of friction on loads under 125 lb. per sq. in. of bearing surface is rather high but, as this grease is generally used where pressures are upward of 100 lb., this is not a serious matter. Curve B shows results on a high-pressure grease and it will be noted that this grease shows better results up to 175 lb. per sq. in.

For loads higher than this the No. 3 cup greases appear to carry the load with less friction. Curve C indicates the results obtained with a No. 3 graphite cup grease. This grease was of similar quality to that used when the test indicated by curve A was made, with the exception that it contained 4 per cent. of high-quality finely-pulverized flake graphite. The graphite tends to reduce the coëfficient of friction at all loads and tends to reduce the cutting action of abrasives that may find their way into a bearing.

Tests can be conducted on this testing machine with bearing pressures up to 1,850 lb. per sq. in. of bearing surface as indicated by the curves shown in Fig. 5. Here, again, it will be noted that there is quite a difference in the results obtained with different greases.

By slight changes bearing pressures higher than those mentioned can be obtained. The speed also can be increased, if desired, by changing the gear ratio.

Power-Shovels.—The power-shovel used in excavating is often poorly lubricated. Due to the conditions under which this equipment operates, sufficient care should be given to lubricants and their application. Money spent for lubricants properly applied will be returned in the form of lower costs for maintenance and parts replacements.

For the steam-engine type of shovel there will be required a cylinder oil with sufficient high-grade animal-oil content so that an adhesive film of lubricant will be formed on the cylinder walls. A compounded cylinder oil will be required because steam reaching the cylinders will be saturated, or what is commonly called "wet steam." In addition to selecting the proper cylinder oil, care should be taken that the lubricator, whether it be of the hydrostatic type or of the mechanical forced-feed type, is working properly.

Should the shovel be equipped with either oil or gasoline engines, then the oil used should conform to the engine builder's specifications or recommendations.

If the electric-motor drive and bearings are oil-lubricated, an oil having a viscosity of 150 to 200

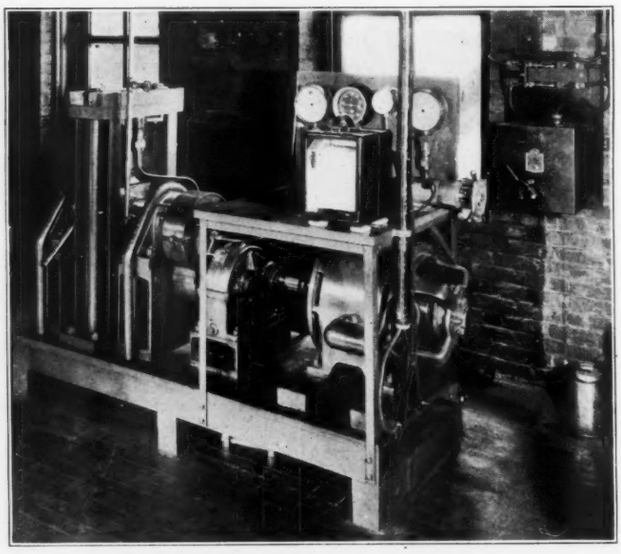


Fig. 3. Bearing-testing machine designed by the author.

sec. at 100 deg. F. will, under ordinary conditions, provide proper lubrication. When high temperatures exist, then an oil having a viscosity of from 300 to 400 sec. should be used. For motors requiring grease lubrication a No. 2 or No. 3 cup grease can be used under normal conditions, and for high temperatures a soda-base grease, having a higher melting point than regular cup greases, should be used.

Where the truck, gear-case, sprocket, chain and other bearings are to be lubricated with oil, this should be one of a viscosity ranging from 500 to 800 sec. at 100 deg. F.

When grease-cups or high-pressure fittings are provided on any of the above-named parts, then cup greases ranging from No. 2 to No. 5 should be used, depending upon local conditions. Some of the large shovel manufacturers use and recommend graphite cup greases for their equipment. They find that,

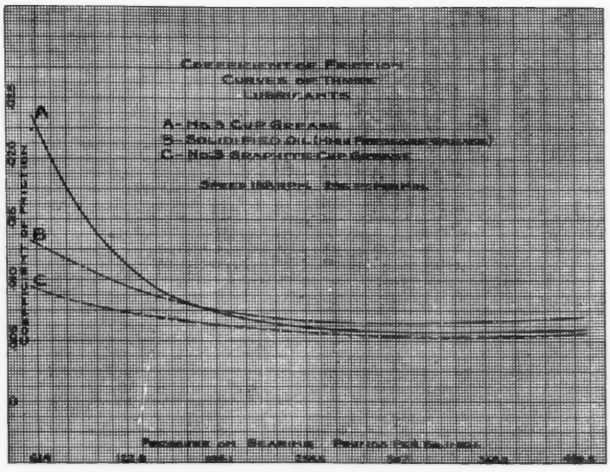


Fig. 4. Test results of three greases.

due to conditions under which power-shovels operate, a graphite grease will prevent premature wear on this type of equipment.

The open gears are usually lubricated with a high-viscosity petroleum lubricant which is very adhesive and puts a protective coating on the gear teeth. This type of lubricant must usually be heated in order to apply it. A lighter material of the same kind can be applied cold or a waterproof petroleum grease can be used. Some of these petroleum greases contain from 10 to 20 per cent. of graphite and provide good lubrication when correctly applied.

The wire rope and cables on power-shovels can be lubricated with the products mentioned above for open gears. Wire rope, if not lubricated, will wear rapidly, due to the friction between the strands of the rope. During the course of manufacture, the hemp core is soaked in the lubricant and grease is generally applied to the strands as the rope is made, but this should not be depended upon to provide lubrication after the rope is placed in service. Any lubricant applied to wire rope must penetrate the inner strands, be free from acid, and be insoluble in water. It should be adhesive enough so as not to drip or run off the rope due to high temperatures or high pressures. It must be applied

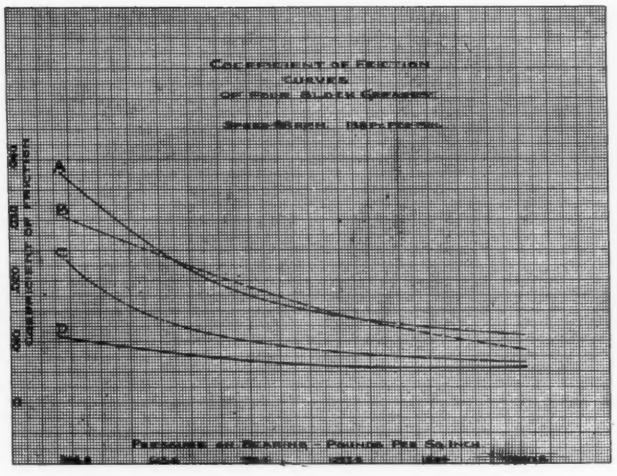


Fig. 5. How four block greases performed.

to the entire rope to be effective, as lubricant applied only in spots will not distribute itself properly.

Crushers.—Crushers may be one of several types: jaw, gyratory, roll, hammer-mill, etc. For primary crushing the jaw and gyratory are probably the most common. If the material is to be pulverized to a fine powder, then there will be used still another type of machine.

Practically all jaw crushers are patterned after either the Dodge type, the Blake type or, in some cases, a modification of either or both. The original jaw crushers were designed for oil lubrication. At present a great many are equipped with compression cups or high-pressure fittings. Those that have been designed for anti-friction bearings usually are equipped with high-pressure fittings.

There are some jaw crushers where a large opening is provided on the pitman and the main-frame bearings and compression cups on the swing jaw. I none design of this type the grease cavities are large enough so that a man can get his hand in to pack the grease against and along the shaft. For this service a grease must be somewhat harder than the usual cup grease and also be able to work in the presence of water, which is sometimes applied directly on the bearing, if regular water-cooled bearings are not installed.

In another type of jaw crusher compression cups are used, and it is to be especially noted that the cups, on both the pitman and the frame eccentric bearings, are automatically operated through a ratchet device by the oscillating motion of the pitman. This is an ideal arrangement assuring positive lubrication to those important bearings at all times. It is, of course, necessary to keep the cups filled, and the length of time between renewals will be best determined by test. A good quality cup grease, ranging from a No. 3 to a No. 5 consistency, should be used.

Graphite cup greases are sometimes used to advantage on crushers. The writer has one case in mind where the operator was using a jaw crusher on trap rock and, when using a No. 3 yellow cup grease, was finding it necessary to shut down the crusher two or three times each day, due to the heating of the eccentric bearing. A No. 3 graphite cup grease was substituted and then shut-downs were not necessary as the bearings ran cooler. Also, the bearings did not require as frequent application through a pressure gun. In this case there were obtained the following benefits due to better lubrication: (1) Longer bearing life; (2) lower power consumption, as a hot bearing always increases the power required; (3) increased production.

Gyratory crushers are in practically all cases designed for oil lubrication. In one design oil is circulated by a pump located in the oil chamber in the bottom plate. This being a gear pump, the supply of oil circulated will be positive as long as the pump is submerged in oil. For this service a good grade of engine oil should be used. An oil with a viscosity ranging from 300 to 500 sec. at 100 deg. F. will generally be found suitable. When the crusher op-

erates under extremely warm weather conditions, a 500-sec. oil or, in extreme cases, one having a viscosity of 750 sec., will be required. However, in cold temperatures a lower-viscosity oil must be used so that it will flow back to the supply base.

In another type of gyratory crusher oil is circulated by the action of a bevel gear and pinion. It is thrown into pockets from which it flows to the points requiring lubrication. An oil of the same characteristics mentioned previously for circulating systems will be found satisfactory for this design of lubrication system. It will, of course, be necessary to carry a sufficient supply of oil in the reservoir and the oil should be examined at intervals to determine whether it requires renewal.

In one type of hammer-mill, which can be used for primary or secondary crushing, the bearings are the only points requiring lubrication. They are of the roller type and an oil pump is provided, as shown, to supply a forced-feed spray to them. An oil of 300 to 500 sec. viscosity at 100 deg. F. will prove satisfactory for this type of equipment. The use of an oil pump assures a constant supply of lubricant for the bearings on this design of hammer-mill.

Conveyors and Elevators.—Many crushing plants use belt-conveyors and elevators for handling material after crushing and also after screening, to carry the finished product to the storage piles or cars. These conveyors do not present any serious lubrication problem as they are usually equipped with ball- or roller-bearings which are inclosed and provided with high-pressure fittings. After the initial filling of these with a good grease of No. 3 cup consistency or a high-pressure grease, it will probably not be necessary to relubricate oftener than every six months.

Some carrier rollers are lubricated from one end only and grease must pass through the central tube or shaft to reach the bearing at the other end. To secure good results it is therefore necessary to fill this space with grease, which must be one that will not dry in service.

Elevators are usually of the bucket type in which the buckets are fastened on belts or chains. The bearings carrying the drive pulleys or sprockets are usually equipped with compression grease-cups. The same lubricant used for other cups on other equipment can be used for this service.

Screens.—While the various designs of revolving screens vary somewhat in the details of their construction, practically all present the same lubricating problem. The parts to be lubricated are the bearings, which usually are equipped with compression cups, and cup grease can be used. The bevel gear and pinion require a heavy-bodied gear lubricant, which must be very adhesive so as to adhere to the teeth under all operating conditions.

There are quite a number of products on the market, some of which are straight-pertoleum products, which must be heated before application. Others are compounded greases which, in some cases, carry from 10 to 20 per cent. of graphite. Greases for this service must be adhesive and waterproof.

Vibrating and shaker screens are usually fitted with compression cups or high-pressure fittings and a No. 3 cup grease will, in most cases, provide good lubrication. In case heating occurs in either the bearings or the eccentrics due to the grease film breaking down, a No. 3 graphite cup grease will often correct the trouble.

Speed-Reducers.—In many of the more modern plants belt drives have been replaced with individual electric-motor drive. Where this is the case, speed-reducers are usually necessary to reduce the motor speed to that required for the proper operation of the driven equipment. The type of lubricant required will depend upon the design of the reducer. There are several types of speed-reducers such as the spur or helical type with single or multiple reduction, where the driving and the driven shafts are parallel; the spur-gear reducer with internal gears, where the shafts are in line; and the worm-gear type, where the shafts are usually at right angles to each other.

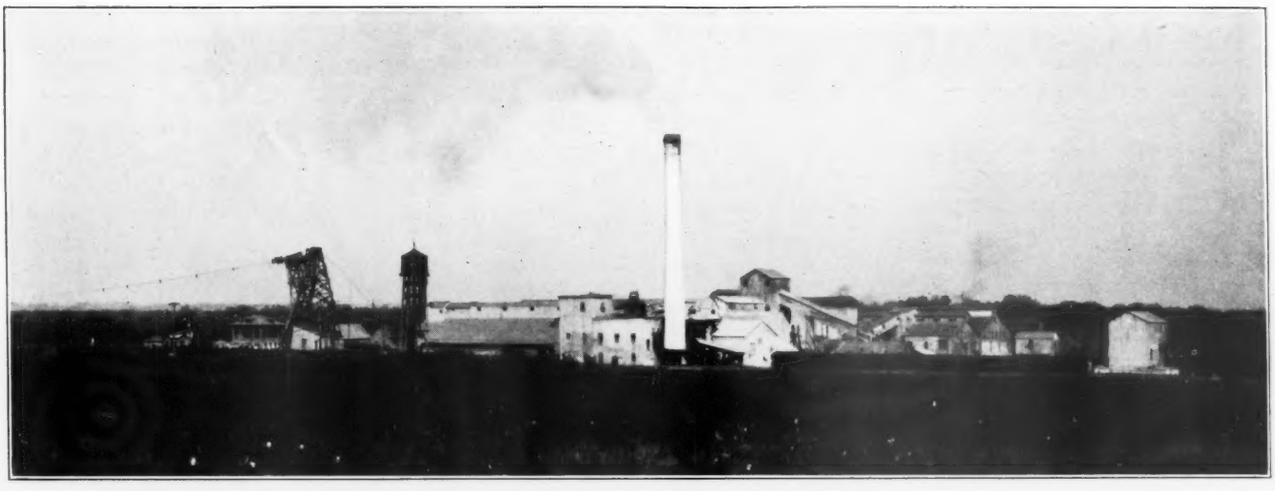
In most cases the spur-gear and helical-gear types will require a medium-heavy-grade oil, which not only lubricates the gears but also the bearings.

For conditions where temperatures are over 130 to 140 deg. F. an extra-heavy oil should be used. When the unit is subjected to temperatures below freezing, an oil with a low cold test must be used. The oil level should be maintained at the proper point for, with an excessive quantity of oil in the gear case, churning will result in high temperatures.

In some designs of heavy-duty speed-reducers provision is made for lubrication of the bearings independently of that provided for the gears. Where such is the case, it is sometimes advisable to use a heavier gear lubricant than can be used in designs where the lubricant must flow through small openings to the bearings. An oil similar to a steam-cylinder oil should be used and, in some cases, compounded gear greases can be used to good advantage. Care must be taken that the lubricant is not too viscous or there will be internal friction and possibly heating of the unit.

Worm-gear speed-reducers require a heavier-bodied lubricant and a general recommendation would be a steam-cylinder oil, or a gear oil having the same viscosity. The writer has, in some cases, found that a gear oil containing from 4 to 10 per cent. of finely-ground flake graphite would give better results than a straight oil. Gear lubricants with a lead-soap base are also used in many cases with good results.

Summary.—In closing, the writer desires to emphasize the necessity for careful attention to the proper application of the correct lubricant in order to secure the best results. The larger plants are finding it profitable to assign the responsibility for the lubrication of all equipment to one man. This usually results in obtaining the best results with the fewest possible number of different grades of oil and grease whereas, when different operators or departments are held responsible, quite a variety is sometimes used with resulting higher inventories.



The Hull, Quebec plant of the Canada Cement Co.

The Growth and Development of Canada's Portland-Cement Industry*

THE consumption of Portland cement in the United States during the course of the past 30 years has shown phenomenal increases. During that time the number of plants has trebled and the value of product has grown from $9,250,000 in 1900 to over $280,000,000 in 1926, the highest annual record yet reached. Actual production has increased from 8,500,000 bbl. to a tremendous total of 176,000,000 bbl. in 1928—the year of greatest production experienced in the history of the cement industry in any country. The per capita consumption has, in recent years, approximated 1½ bbl. Overexpansion in capacity has lately overtaken the industry.

While kiln capacity in individual plants is of necessity planned somewhat in excess (10 to 15 per cent.) of production requirements, there have been some cases of plant additions and new unit construction in regions already overproduced. The development of competition, which is responsible for the present situation, in all probability will eliminate considerable uneconomic production capacity.

Since 1925 there has been a movement toward lowering the ratio of production to capacity. With production advancing much more rapidly than consumption, the relative positions of the representative curves indicate that, without any further increase in capacity, the requirements of the domestic markets (assumed to increase at an average nominal rate) might easily be met for 20 or more years to come.

In the future, in addition to the likelihood of plant shut-downs, there will come radical but natural improvements in technology of process, which will render some of the present equipment obsolete. In fact, this tendency has already begun to be felt. Changes in the standard of cement have not been conspicuous in the past, doubtless because the rapidly growing demand hardly required them. However, during the course of the recent past, competition has become keener with falling demand, and in December, 1930, the American Society for Testing Materials set up the first change in cement specification standards since 1922.

In comparison with many other commodities, cement has not been of any great significance in American export trade. Whereas it has been held that normally annual exports might involve 15,000,000 bbl. or more, actual exports have never exceeded 3,000,000 bbl., and in recent years have fallen well below 1,000,000. Several strong reasons would appear to account for this seeming apathetic attitude toward foreign outlets, among them the relatively high cost of production in the United States. Another, though none too important, factor is in the limited proportion of cement plants advantageously located with respect to seaboard, with nonfavoring freight rates on outgoing cargo form a third.

Whatever the exact reason or reasons for the limited interest in foreign markets in the past, this attitude is changing, and there has appeared a striking increase in the demand on the facilities of the Bureau of Mines to supply pertinent data indicative of nearby market possibilities.

In general, it may be stated that on the basis of quality the cement of the United States meets no prejudice in competition with foreign brands, but it seems that price alone is the outstanding factor which must be met. However, while price reduction and consumption requirements have been drastically cut in practically every producing country of the world—preeminently Europe—price lowering in the United States during the past few months has been proportionately far greater than elsewhere. It would seem then that, with recent favoring changes in the freight rate on outgoing

* From Special Circular No. 1, U. S. Dept. of Commerce.

PHYSICAL CHANGES OCCURRING IN THE CANADIAN CEMENT INDUSTRY SINCE 1925

	1925	1930	Change	Percentage of Change
Capital	$38,081,583	$59,210,737	plus $21,129,154	55.
Output	(a) 7,869,946	11,790,408	plus 3,920,462	49.8
Salaries and wages	$2,511,400	$3,172,198	plus 660,798	26.3
Fuel and electricity	$2,848,904	$4,120,367	plus $1,271,463	44.6
Selling value	$14,046,704	$17,713,067	plus $3,666,363	26.1
Employees	1,926	2,317	plus 391	20.3
Output per employee (*bbl.*)	4,086.16	5,088.65	plus 1,002.5	24.5
Salary per employee	$1,303.95	$1,369.09	plus $65.14	5.0
Barrel Values:				
Capital outlay	$4.839	$5.02	plus $0.183	3.8
Labor cost	$0.319	$0.27	minus $0.050	—16
Fuel and electricity	$0.362	$0.35	minus $0.012	— 3.3
Selling value	$1.785	$1.50	minus $0.283	—15.9

(a) Barrels of 350 lb.

cargo to countries to the south exporters of cement from the United States might reasonably be permitted by careful marketing to enjoy a greater share of the export trade than has heretofore been the case.

As an export market for American cement, Canada presents practically negligible possibilities, except for such special varieties as white and quick-setting cement. More than 80 per cent. of the Dominion's requirements is met by one company—the Canada Cement Co., whose plants are strategically located in practically every area in which they are justified by local demand. With conditions of manufacturing in Canada fairly similar to those in the United States, American cement could hardly expect to overcome transportation costs and imposts with any degree of success, and Canadian cement can not compete in the United States for the same reasons.

The Portland Cement Assn. has estimated that 15 per cent. of all the cement consumed in the United States is used for rural structures exclusively. Assuming the same percentage as applying to Canada, it is estimated that the 5,000,000 urban population or 50 per cent. of the total probably uses about 85 per cent. of the cement nationally produced. On the basis of 1930 figures this portion of the population had a per capita consumption of between 1.8 and 1.9 bbl. Such figures are highly significant with respect to probable future increases.

Canada's development has been unusually rapid over the past two decades largely due to immigration, which has created an increasing demand for cement. While this movement has essentially subsided for the time, it is not unreasonable to anticipate that further development of consuming markets will be in order and that the per capita consumption of cement will increase with the individual's purchasing power.

The history of the cement industry in Canada is very largely one that involves the subsidiary groups of one company, the aforementioned Canada Cement Co. As previously noted, the plants of the organization account for most of the total national output. Originally incorporated in 1909 to acquire a number of plants, it has grown to the point where by reason of plant distribution, it may be considered completely dominant except in British Columbia. Two of the companies acquired in 1909 originally produced cement in 1899, the first year of cement manufacture in the Dominion. In 1927, Canada Cement reorganized but retained the same name under which operations had been carried on previously. In 1929 it absorbed the National Cement Co. of Montreal, which had commenced production in 1925 but had been purchased by Toronto interests in 1928. The controlling interest is held by Canadian citizens.

Four other firms are operating in the industry at present. With the exception of St. Mary's Cement Co. in southwest Ontario, these plants are all located around Vancouver, British Columbia. Total cement capacity of all plants in Canada, operating and nonoperating, in 1930 was nearly 16,000,000 bbl. of 350 lb.

With a production of 11,032,539 bbl. of cement having a value of $17,818,451 during 1930, corresponding to $1.62 a bbl. of 376 lb., the average mill price approximates $1.51 per Canadian bbl. This figure, however, is of principal value only in comparing general annual price changes. The price per bbl. in the Prairie Provinces is somewhat higher as a rule than in the eastern or western producing centers. The average annual mill price has advanced with each succeeding year since 1926, continuing in 1930. This is in marked contrast to the descending value per unit evidenced in the United States and certain European countries over a like period.

The tabulation of the physical structure of the Canadian cement industry for 1925 and 1930 shows many interesting changes. It is for the most part self-explanatory, but it may be of value to point out that with greatly increased capital outlay, permitting greater capacity, unit operating costs (insofar as the table indicates) have decreased. While this is naturally in line with modern practice and consequently is to be expected, it is apparent that there is no constant ratio between the increasing capitalization and decreasing operating costs.

With an increase in production of nearly 50 per cent. during the five-year period, the number of employees increased but 20 per cent. and the output per man 24.5 per cent. Theoretically, and assuming an expanding market, a point might be reached where the operating profit would range near 40 per cent. However, sales costs and the necessity of keeping prices in general line with competitive possibilities, suggest that the past 5-year record may not be maintained.

The decline, in selling value between 1925 and

1930 is noted as approximately 16 per cent. that of apparent manufacturing profits (capital outlay per barrel considered from a 10-yr. base) in the same period shows a decline of approximately the same percentage, although that any such correlation is actually intended is questionable.

The Canadian output, month by month, during the past calendar year, was as follows:

1930	*Barrels (350 lb.)*
January	269,195
February	295,810
March	448,884
April	781,736
May	1,206,554
June	1,313,683
July	1,504,508
August	1,466,953
September	1,402,769
October	1,180,205
November	709,671
December	452,571
Total	11,032,539

To the above should be added stocks on hand at the close of 1930 amounting to 2,246,621 bbl., compared with 1,488,751 bbl. at the close of the preceding year.

CANADIAN PRODUCTION AND SALES

Year	Production (*Canadian bbl. of 350 lb.*)	Value	Sales	
			Canadian bbl. of 350 lb.	*United States bbl. of 376 lb.*
1920		$14,798,070	6,651,980	6,192,002
1921		14,195,143	5,752,885	5,355,079
1922		15,438,481	6,943,972	6,463,803
1923		15,064,661	7,543,589	7,021,957
1924		13,398,411	7,498,624	6,980,102
1925	7,869,946	14,046,704	8,116,597	7,555,342
1926	9,041,411	13,013,283	8,707,021	8,104,930
1927	9,927,163	14,391,937	10,065,865	9,369,810
1928	11,076,659	16,739,163	11,023,928	10,261,623
1929	12,252,203	19,337,235	12,284,081	11,434,637
1930	11,790,409	19,818,451	11,032,539	10,269,639

Despite the fact that 1930 marked a general recession in Canadian business, sales of cement were actually higher than in 1928, although 1930 production exceeded that in the latter year by 713,750 bbl., the resulting excess being reflected in stocks. An interesting feature in the expansion of the industry has been a somewhat well-defined rate of annual increase, averaging 600,000 bbl. Until 1930 stocks on hand have been kept down in relatively close ratio to output, but during that year the seemingly anticipated utilization of cement in large public and private construction works was not realized, possibly accounting for the curtailment of production.

Imports of cement into Canada have never been of great significance, comprising almost entirely cements of special manufactures and uses. In 1929 a total of 52,109 bbl. was received, invoiced at $189,169, or an average of $3.63 per bbl. This average value is higher by about $2 than the average Canadian f. o. b. mill price during the same year.

The trend of Canadian exports has been downward for the last five years. The high point of shipments was reached in 1926 with 285,932 bbl. (350 lb.) valued at $358,231. This quantity represents roughly 3 per cent. of production in that year.

It is notable that the larger part of exports is consigned to British possessions, where such duties as may exist are decidedly favorable to the Canadian exporter. Canadian cement is manufactured under much the same conditions as in the United States, and consequently, like the American product, competes at a disadvantage in foreign markets. In this connection it may be noted that a rather high percentage of United States cement shipped to countries of Latin America is made up of special brands not strictly in the same price class as gray Portland cement.

Detailed receipts for 1930 are not available, but since 1925 the United Kingdom has not been reported as a source of imported cements. The United States is the outstanding shipper of the limited quantities involved.

The Canadian tariff (not applying in Newfoundland) provides under Item No. 290 for a duty of $0.08 per hundred upon imports from the United States on "cement, Portland and hydraulic or water lime, in bags, barrels, or casks, the weight of the package to be included in the weight for duty." This compares with the United States tariff on foreign cements of $0.06 per 100 lb., including the weight of containers on "Roman, Portland and other hydraulic cements or cement klinker," with white nonstaining Portland cement at $0.08 per 100 lb., also including the weight of the container. Cement imported into Canada is further subject to a sales tax on the duty paid value unless imported by a licensed jobber or wholesaler for resale.

Newfoundland.—Aside from the small, somewhat

DATA ON CEMENT COMPANIES IN CANADA

Name	Location	Province	No. Plants	No. Operating Jan. 1931	Normal Number of Working Days	Daily Capacity (*bbl.*)
Canada Cement Co.	Montreal, East	Quebec	2	1	300	
	Hull	Quebec	1	1	300	
	Belleville	Ontario	2	1	300	
	Port Colborne	Ontario	1	1	300	
	Lakefield	Ontario	1	Part time	200	
	Winnipeg	Manitoba	1	1	200	5,800
	Blairmore	Alberta	1	Not operating	...	1,000
	Exshaw	Alberta	1	1	200	3,000
	Calgary	Alberta	1	Not operating	...	1,500
British Columbia Cement Co., Ltd.	Tod Inlet, V. I.	B. C.	1	Not operating	...	
	Bamberton, V. I.	B. C.	1	1	...	1,500,000 annually
Coast Cement Co.	Vancouver	B. C.	1	1	...	
A. MacDonald Co.	Marlboro	Alberta	1	1	200	1,500
Commercial Cement Co.	Winnipeg	Manitoba	1	Not operating	...	225
St. Mary's Cement Co.	St. Mary's	Ontario	1	1	290	5,000

scattered population, and the fact that the country is heavily wooded, permitting the extensive use of lumber at low cost, the manufacture of cement has not as yet been undertaken in Newfoundland, nor are there indications that the demand justifies the erection of even a small plant.

With the exception of the larger business houses in St. John's constructed mostly of brick and stone, together with several large industrial and public buildings, utilization of cement is confined to concrete foundations, highway and railroad bridges, and occasionally dam construction.

The Newfoundland customs in compiling import statistics on cement prepares values without reference to applying quantities. The valuation of imports was $32,292 in 1927, $45,167 in 1928, and $18,780 in 1929. Naturally enough the principal source is Canada. The United Kingdom and the United States furnish occasional supplies and significant quantities come from certain of the Northern European countries.

Wholesale and retail prices as of December 20, 1930, together with other incidental charges are here noted. It is obvious that the high cost of cement to the ultimate consumer hardly favors its wide use (aside even from limited purchasing power and factors of population, distribution and popularity of materials):

	Wholesale	*Retail*
Canada Cement, Montreal, Canada	$3.50	$3.60
Dalen Portland Cement, Norway	3.10	3.40
Norden Portland Cement, Allborg, Norway	3.30	3.60
Portland Cement, Belesmore Port, England	3.30	3.85

The cost of Canadian cement to the importer as of the above date was $2 per bbl. f. o. b. Montreal, and that of Norwegian cement $1.38 per bbl. f. o. b. port, Norway.

The Newfoundland customs tariff provides for an ad valorem duty of 35 per cent. on "Portland. Roman and hydraulic, water lime and iron oxide, fiber and flooring cement." In addition to this duty a 5-per cent. sales tax is added to the invoice price of all imports.

Receipts of cement are handled either at the docks owned by importers at St. John's or by means of lighters from ocean-going steamers. In the former case the cost of handling approximates $0.12 and, in the latter case, $0.24 per bbl.

At the beginning of the current year the freight rate on cement in bbl. of 375 lb. at St. John's was $0.70 from Montreal, $0.65 from Norway, $0.60 United Kingdom, and $0.66 from the United States (Boston). Calculating, as an example, the unit profit to the importer on the sale of cement from Allborg, Norway, and using the above costs totaling $2.82, a firm having to lighter cement from ship to dock would probably realize something less than $0.78 per bbl. on a retail sale. Judging from present day profits, this amount is thought to be fairly reasonable, but total returns are limited by actual demand. The climate of Newfoundland is extremely damp and requires that wooden barrels or casks be employed for all shipments. The empty containers themselves have some demand and bring about $0.15 each.

While no government regulations require labeling of foreign cement, it is stated by Consul George C. Cobb of St. John's that the word "cement" should be plainly marked on the outside of the container in order that general precautions may be taken to protect it from dampness.

Deposits of limestone are at present being worked at Aguathuna on the western coast of the Island for use as a flux by the Dominion Iron Steel Co. About four miles from the mouth of Humber River is located another deposit supplying a British paper mill at Grand Falls. Other available raw materials thought to be suitable for cement manufacture are gypsum at two deposits on the western coast and clay found near Random, Trinity Bay, on the eastern coast. The single coal deposit discovered at the foot of the Long Range mountains is said to contain a reserve of minable coal approximating 2,000,000 tons. No development work has ever been undertaken at this property. State construction work, confined principally to bridges, foundations and footings for minor structures, has been considerably augmented during recent months, principally to aid unemployment in the colony. However, no definite program exists and the work is carried on as available funds permit.

Maritime Provinces.—The Canadian climate, generally more severe than that of the United States, is modified in the Maritime Provinces. Nova Scotia has a distinctly warmer winter than New Brunswick, and the southwestern part of the former province is the only area of Eastern Canada where the normal mean temperature in January is above 25 deg. An estimated population of this region for 1930 is somewhat in excess of 1,000,000. The people are a mixture of French and Anglo-Saxon races, the latter predominating. The leading industries are agriculture, the mining of coal, gypsum and limestone, lumbering, and limited manufactures.

The demand for cement in the Maritime Provinces has increased notably in the past few years primarily due to generally active building construction programs, and it is anticipated that future requirements, while perhaps not increasing, will be maintained at the present annual rate of about 300,000 bbl. A number of construction projects chiefly in connection with port works at Halifax, Nova Scotia, and St. John, New Brunswick, will necessitate the consumption of moderate quantities of cement in 1931, these two provinces consuming the largest portion of receipts since Prince Edward Island is predominently agricultural.

While there is no production in this region and supplies are brought from plants in other provinces, it is reported that a company has been organized in New Brunswick during the course of recent months, receiving a charter under the name of the Maritime Cement Co. It has an authorized capital of $1,000,000, and is controlled by a Canadian group which also controls considerable deposits of raw material necessary for production. By way of history it is further reported that the

Canada Cement Co. prepared plans two years ago for the construction of wharfage facilities and warehouses at St. John, N. B. It was then estimated that a plant having a production capacity of close to a million barrels would be necessary to operate efficiently, whereas actual market demand ranged around 100,000 barrels. These plans were never brought to fulfillment and may have been influenced by the formation of the Maritime Cement Co. Unlike Newfoundland, and in spite of the wet climate, cement is delivered in paper bags of 87½ lb. Wholesale prices at Halifax on the first of the current year approximated $2.31 per bbl. (350 lb.) f. o. b. car in carload lots and the cement retailed for $2.80 per bbl. This compares with prices of $2.66 and $3.20, respectively, in the corresponding period of 1929.

At St. John, New Brunswick, on December 18, 1930, the wholesale price was $2.50 per bbl. and retail price $3.10. Broadly, these values are $0.40 more than for the same cement, under the same economic conditions, in the summer. During the summer months a competitive rail rate is said to be in force in order to meet cheap water transportation. Navigation closes about December 1 and does not open until late in April, depending on the severity of the winter.

Wholesale quantities of cement are obtained by dealers direct from Montreal factories in large lots, as is the general custom in the United States. One producer's distributing organization is reported to have established cement storehouses at Halifax and St. John in 1929, and is controlled by the Canada Cement Co. of Montreal. It is understood that this organization has a maximum storage capacity of 30,000 bbl. in bulk, brought in especially constructed boats, but distribution is confined to a very limited area.

Distribution in St. John is effected by the firm of Gandy & Allison, specializing in builders' supplies and acting as wholesale and retail agents. Adequate supplies of cement making raw materials are available. Cement consumption and probable future demand, however, are hardly expected to warrant their development for cement manufacturing purposes.

Nova Scotia, New Brunswick, and Newfoundland, because of nonproduction, would appear to be the most logical points of penetration for foreign cement, but as the presence of many factors intended to protect Canadian cement manufacturers, collectively, would seem to preclude American participation in the domestic markets, other than a general discussion has not been attempted. Aside from normal protective customs imports, sales taxes, freight charges, registration fees on foreigners' sales offices and certain kinds of sales personnel, the Canadian industry is so organized as to production costs and distribution systems that, excepting special brands not manufactured in Canada, the sale of United States Portland cement generally can not be effected in these or other areas.

Ontario.—Ontario, with its sister province, Quebec, lies in probably the most favored Canadian environment, and its cement plants contributed over 37 per cent. of Canada's record output in 1929. While the northwestern portion, aside from mining developments, is relatively unimportant, the areas bordering on Lakes Superior and Ontario enjoy much the same conditions as the states of New York and Ohio. Further, the greatest population concentration of Canada is here and its 3,251,000 or more people represent one-third of the entire Dominion total. The Canada Cement Co. maintains its major production in Eastern Ontario, and it has two plants located at Bellville and one each at Port Colborne and Lakefield. Of the four plants, two are in continuous operation at present. A fifth plant is operated by the St. Mary's Cement Co., Ltd., of St. Mary's, a private company with controlling interest held by the officers of the Elias Rogers Co., Ltd., of Toronto. Neither company controls the other; they are separate organizations in spite of the fact that the same individuals hold controlling interests in both.

The company produces Portland cement exclusively, using the wet-process and coal imported from the United States. There seems to be no intention to extend operations to include any other type of product. The factory uses machinery partly of American and partly of Canadian make.

The sales territory of the St. Mary's consists of the province of Ontario generally. It is believed that this company and the three plants of the Canada Cement Co. manufacture the bulk of the cement sold in Ontario. The local trade has no particular prejudice against imported cement, but the price of the domestic output is almost always sufficiently lower than prices on imports to insure sale. Each company maintains its own sales organization and no agreements as to production, territories or prices are known to exist, but quotations from the different manufacturers are practically identical at all times. On January 27, 1931, Portland cement was quoted at $2.52 a bbl. wholesale and $3.25 retail, and a price of $11.50 was given for quicksetting imported cement. Prices are regularly quoted on barrels of 350 lb. each, although practically all cement is sold and delivered in paper bags of 87½ lb. When cotton bags are used, a refund of 20 c. per bag is usually allowed. Prices are subject to a discount of $0.10 per bbl. for cash in 20 days. Retail prices obtain on quantities of 5 bbl. or less, and wholesale prices on larger quantities. Prices still low might be obtained on orders running into several carloads.

Imports are small and consist almost exclusively of quicksetting or other special kinds of cement not produced locally. Practically none finds its way far inland.

The use of cement in Ontario is practically identical with that in the northeastern part of the United States. No usual construction projects were contemplated in early 1931; 1930 construction showed some decline from 1929 figures and it is not expected that 1931 will increase greatly, but a fair amount of building is expected.

Considerable limestone occurs in the western and

northern areas of Ontario, but apparently it is too impure for metallurgical uses or to be burned to lime. The limestone is almost flat-lying, siliceous, and overlain by 175 or more ft. of basalt. A large area of limestone exists on the James Bay slope in Northern Ontario and is exposed at intervals along some of the river valleys, and similar material is found on the north shore of Lake Huron.

Gypsum was first discovered in Ontario near the site of Paris, and was later found in a number of localities, underlying areas in nine counties. There are also occurrences in northern Ontario along the Moose River and its tributaries.

Clay is scarce over a large part of western Ontario. In the eastern and northern sections a number of deposits exist, but they would not generally constitute raw materials for cement, according to the department of mines for the province.

There is no commercial coal production in Ontario, and the province is unusually barren of coal resources. Known deposits are reported to be lignite, and there is some possibility of future minor fuel production from the beds in the northern part of the province. Other fuels are not believed to be available in sufficient quantities to stimulate cement production.

The Canada Cement Co., Port Colborne, Ont., as a result of being granted a fixed annual assessment of $10,000 for 25 yr., and is now spending $500,000 for improvements, which include one long kiln and conversion to the wet process of manufacture. Elimination of dust will also be accomplished.

Quebec.—Quebec is largest in area and second in population among the Canadian provinces. The population is largely concentrated in the vicinity of the St. Lawrence. Water and rail transportation facilities, favorable climate and adjacent to a developed and growing region of the United States point toward rapid expansion of this already important territory. The cities of Montreal and Quebec, the former the largest in the Dominion, have shown a remarkable growth in the past 20 yr., and seem to promise a considerable future consumption of cement, which is now supplied almost exclusively by the Canada Cement Co. plants, three of which are located in this province—two at Montreal East, and one at Hull.

All of the output of this company is manufactured by the wet process. The market for cement is sufficiently well concentrated to eliminate practically all competition from Canadian companies which might normally be expected. Distribution is effected by direct sales to large consumers and construction projects, shipment being made by railroad or water, according to season. Limestone is quarried along the southern margin of the Laurentian Plateau, with Portage du Fort as a notable producing point. Other important locations where sedimentary limestone is quarried are at Dudswell, Phillipsburgh, and St. Marks near Montreal and Hull. No difficulty is experienced in obtaining adequate supplies of clay, but gypsum and coal must be imported into the province. Supplies of the latter are obtained from the United States and eastern Canada. It is reported that estimated consumption of Portland cement for 1931 will probably show a slight increase over 1930, insofar, as the Province of Quebec is concerned, although residential and office building construction will be very greatly reduced. Certain construction projects being carried forward will require large quantities.

Prairie Provinces.—In spite of their great area, consumption and production of cement in the Prairie Provinces are confined to the lower third of Alberta and the southern quarters of Saskatchewan and Manitoba. Of the six plants situated in this area two are located in Winnipeg and four in Alberta. Of these but three operate during the spring, summer, and autumn. Since the wet process of manufacture is used exclusively, there is no winter operation. Two of the Canada Cement Co. plants are considered as regularly operating, one at Fort Whyte and another at Exshaw, Alberta. The third, an independent operator, is located at Marlboro in the Peace River district of Alberta. The plant is owned by the A. MacDonald Co. at Winnipeg. Of the plants which have remained consistently idle, two are owned by the Canada Cement Co., and are located at Calgary and Blairmore, Alberta, respectively. The third plant is located at Winnipeg and is known as the Commercial Cement Co. Only Portland cement is produced in the Prairie region. The Canada Cement Co. plant at Exshaw uses calcium chloride to shorten the time of set and permit use at freezing temperatures. The unit of weight is the 87½-lb. paper bag, although cloth bags are supplied on request. From the Winnipeg plant of the Canada Cement Co., cement is shipped as far east as Fort Arthur and Port William. The freight rate between Winnipeg and the lake head has recently been equalized with the rate to Montreal for these two cities. With a single operation at Winnipeg and with imports negligible, Winnipeg represents the center of distribution to Saskatchewan. Plants at Exshaw and Marlboro penetrate to central Saskatchewan and eastern British Columbia. According to a report from Trade Commissioner John A. Embry at Winnipeg, a need has long been felt for the establishment of a cement plant at or in the vicinity of a lake head city of Ontario. The construction of grain elevators and harbor improvements has consistently required large quantities of cement, probably averaging around 200,000 bbl. annually. Since, as noted, requirements must be met either from Winnipeg or Montreal with the attendant relative high freight costs, the price per barrel of cement at the lake ports of Port William and Port Arthur is about $1.20 more than the quoted mill price at Montreal. The freight rate on coal from Lake Erie ports to Port Arthur is $0.35 a ton, and it is argued that development of known deposits of limestone and shale a well chosen plant location would be economically justified. Cement plants in this district as well as throughout practically the entire Dominion sell only to jobbers and wholesalers. The wholesale price f.o.b. Winnipeg on February 14, 1931, was $2.61, with an extra charge of $0.15 to

pay for the bag, bringing this quotation to $3.21. No allowance is made for return of containers, although used cloth bags in good condition in a few cases bring $0.20. An 87½-lb. paper bag retails for $1. It is believed that the demand for cement in the Prairie Provinces will increase with the construction of hydroelectric development at Seven Sisters Falls and Slave Falls on Winnipeg river. In addition a number of grain elevators are to be located at various points throughout the region among them Churchill, Manitoba, Port Arthur, and Port William, Ontario.

British Columbia.—Cement production in British Columbia, as reported by the Provincial Bureau of Mines, was 523,931 bbl. valued at $1,182,552 in 1927; 670,796 bbl. valued at $1,495,204 in 1928; 680,903 bbl. valued at $1,487,223 in 1929; and 721,045 bbl. valued at $1,489,233 in 1930.

Of the three cement plants supplying the western section of British Columbia, one carries the manufacture from raw material to finished products; one is idle, deposits of limestone having been worked out; and the third, which is very small, is used to grind clinker imported from abroad, principally from Europe, although receipts of Japanese clinker have been indicated. The British Columbia Cement Co., Ltd., of Victoria, owning the first two plants mentioned, is reported to be about equally divided between Canadian and English capital. The regularly producing plant is located at Bamberton on the west side of Saanich in Vancouver Island, and is reached by highway. The second of this company's plants is located at Tod Inlet, also on the Saanich peninsula. The clinker-grinding plant is operated by the Coast Cement Co. at Granville Island, situated in Force Creek in the heart of Vancouver. The company is said to be completely owned by Canadian capital. It is reported that the production of the Coast Cement Co. is small, and that the two plants are capable of producing about 1,500,000 bbl. annually. The 1929 production of the latter company was about 700,000 bbl., but figures for 1930 are not available.

These plants use the wet process. The British Columbia company uses local coal in a pulverized form, the annual consumption being reported at about 40,000 tons. Plant equipment is reported to be practically all of English origin, but the weighing machinery is said to be of American manufacture or else produced in subsidiary plants in Canada. Sacking machinery is also used, but particulars as to their manufacture are not available. The usual cement containers are wood barrels, paper-lined, or jute sacks containing 87½ lb. Distribution is usually by sack, and the customary allowance of $0.20 is made for their return in good condition. Paper sacks are not in general use, although an attempt has been made to introduce them. No further plants are contemplated, so far as is known.

Sales are largely in or near Vancouver and Victoria, which contain more than half the population of British Columbia. Sales territories include the coast of the mainland, with the largest market at Prince Rupert, and the interior sections of the province as far east as the Okanagan district, beyond which freight rates operate against shipping.

There is no distributing organization of producers, nor any evidence to indicate the existence of agreements between them on sales, which are generally made through agents. The largest distributor states that there are practically no imports into this area, with the exception of small quantities of white cement from the United States. Imports are required to have the country of origin shown on the containers. Handling charges at Vancouver wharves are $0.65 a short ton, or 40 cu. ft.

On January 31, 1931, domestic Portland cement was sold wholesale at $2.60 a bbl. of 350 lb., f.o.b. Vancouver, plus sales tax. The retail price of Portland cement on the same date was 20 or 25 per cent. over the wholesale price, or $3.12 to $3.25 per bbl. These prices cover the average sales; on a recent contract of considerable proportions the successful bid was $2.72 a bbl.

As in the case in the provinces to the east, building construction of a neutral type has slackened off considerably in recent months. However, public construction work has been given an increasing impetus during that same time through the medium of several major projects, including the Canadian Pacific Railroad tunnel and the Burrard St. Bridge. Grain elevators, highway construction and the possibility of at least one other tunnel should be of considerable assistance in consuming cement in the near future. Excepting the exhaustion of the limestone deposits at the Bamberton plant, it appears that supplies of raw materials are abundant.

Japan Curtails Cement Output to Avoid Overproduction

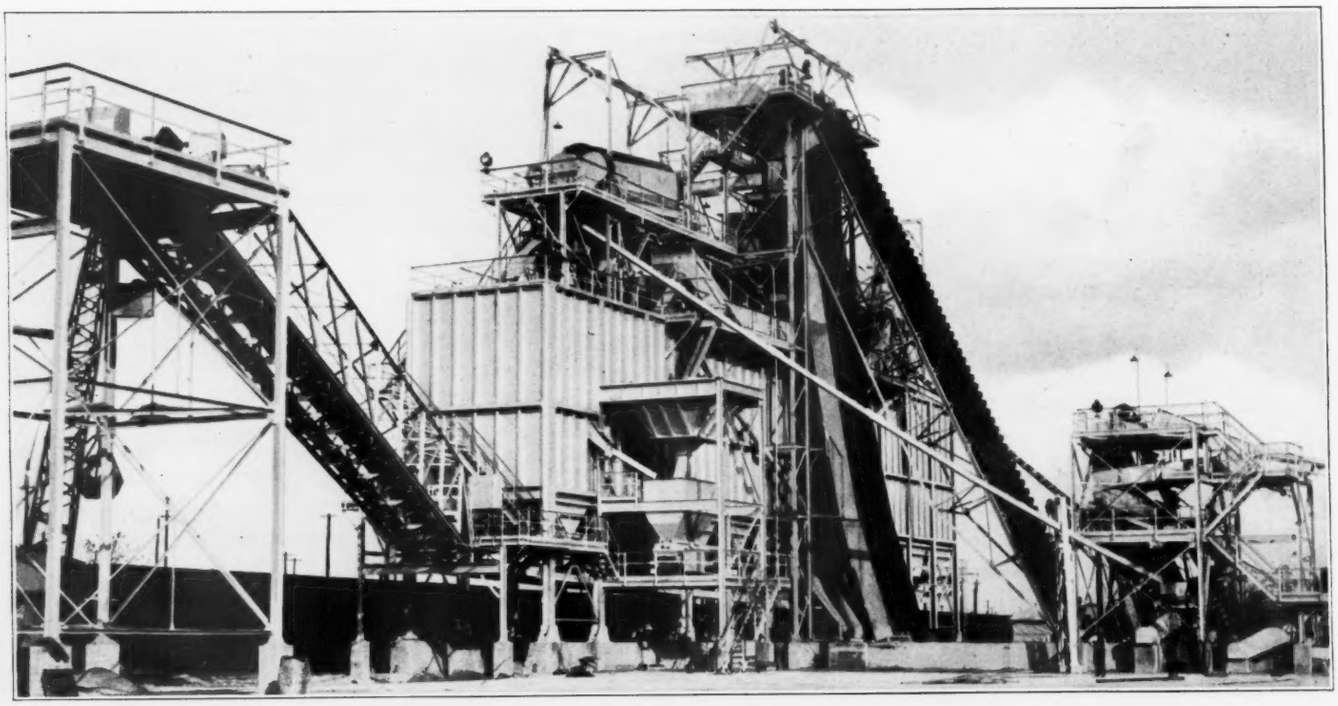
Japan increased its cement output by over 60 per cent. during the past five years, according to figures presented in a recent industrial report of the economic section of the League of Nations. Its last year's total was 3,700,000 metric tons, rather more than that of Italy and twice that of Canada. It has all but captured the East Pacific and South Seas market. This at least was the situation up to the middle of 1931.

A further report of the Japanese Cement Rengokai, or cartel, has recently decided to reduce production to 57 per-cent. capacity for the next three months. The sales movement during the past months, owing, it is claimed, to an excessive rainy season, has proved far from satisfactory, with inventories of stocks on hand piling up to 312,000 tons, as compared with less than 200,000 tons six months ago.

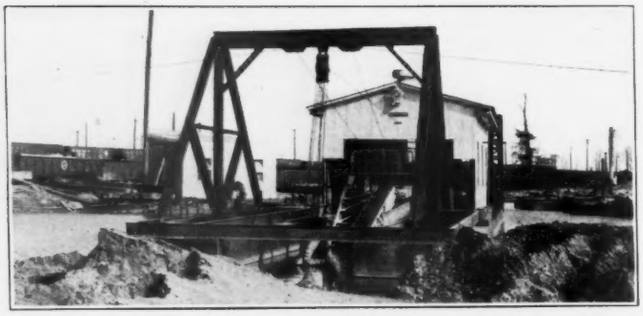
The curtailment, as ordained by the consortium authorities, falls especially hard on the smaller producers working with less modern and less efficient machinery than on the larger plants, like those of the Asano and Onada companies.

Production of July showed an increase of 7 per cent. over a year ago, but sales of the consortium during the same month fell off 11 per cent.

A Story in Pictures of the New Aggregates



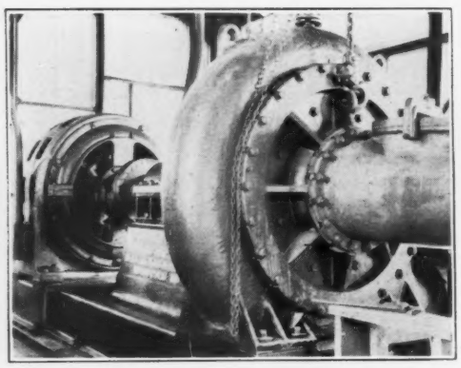
Received from the dredge (*below*) by the scalping-and-crushing building at the right, the material is first scalped and crushed and then elevated to the sizing plant at the top center and passes, by the conveyor at the left, from the bins to the stock-piling conveyor, shown at the bottom of the next page.



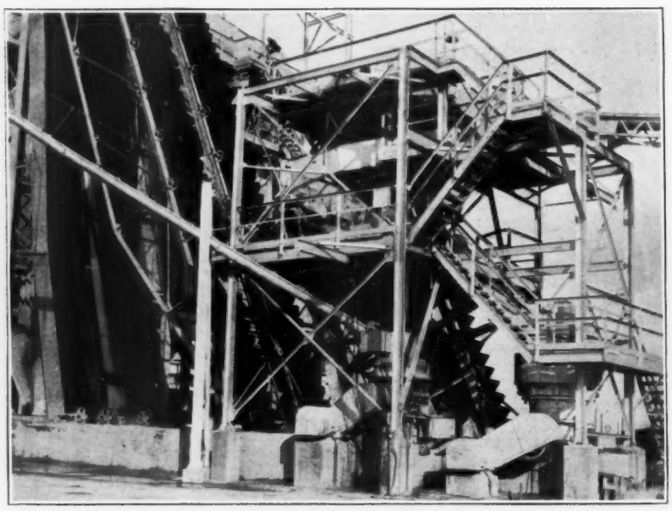
Here the dredge, viewed from the front end, is seen doing its first excavating in the newly-opened pond. One of the spuds is shown at the rear and portions of the pipe-line leading to the plant at the left.

THE year 1931 has given the sand-and-gravel industry comparatively few new plants but these same few have been exceptional in many respects. The new plant of the Curtis & Hill Gravel & Sand Co., Morrisville, Pa., illustrated on these pages, is a conspicuous example of the present trend toward better and more permanent construction and more thoughtful planning in engineering design. This new plant, embodying the most advanced engineering knowledge in its design will be fully described in an early issue.

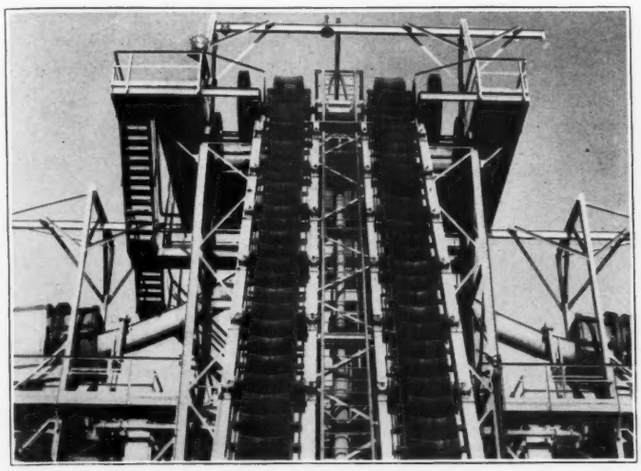
The dredge pump, a 15-in. centrifugal unit, its 500-hp. motor, and the pump's principal roller-bearing are seen below.



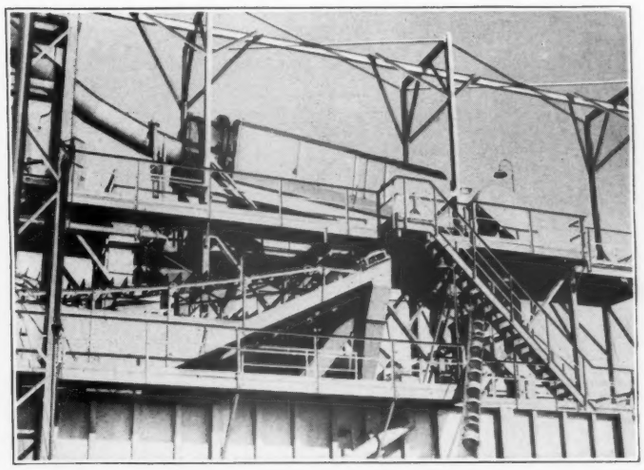
At the right is the scalping-and-crushing building and the elevators which lead to the screening plant above. Oversize returns to the crusher through the sloping chute shown.



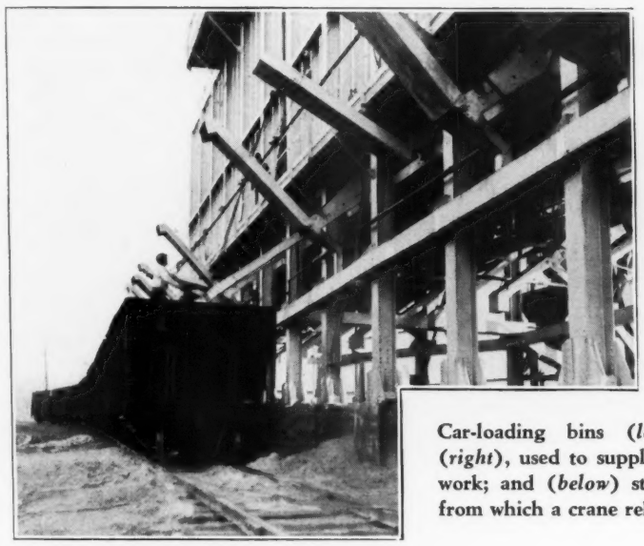
Plant of Curtis & Hill Gravel & Sand Co.

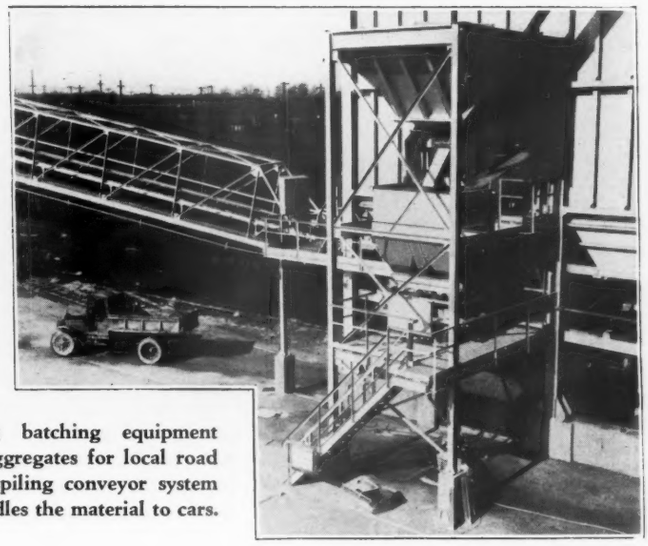


Looking up the elevators and the ladder installed between them toward the sizing plant. The feeds to the rotary screens can be seen at the left and right.

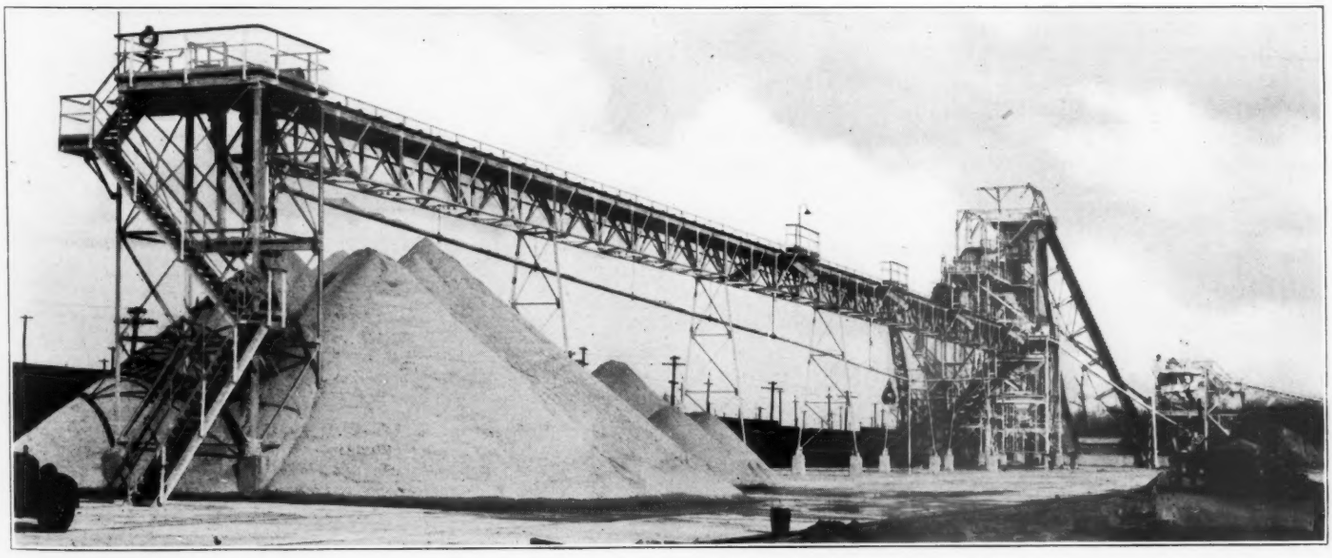


In this near view of one of the rotary screens are shown the chutes to the storage bins, the return chute to the crusher and one of the sand drags.

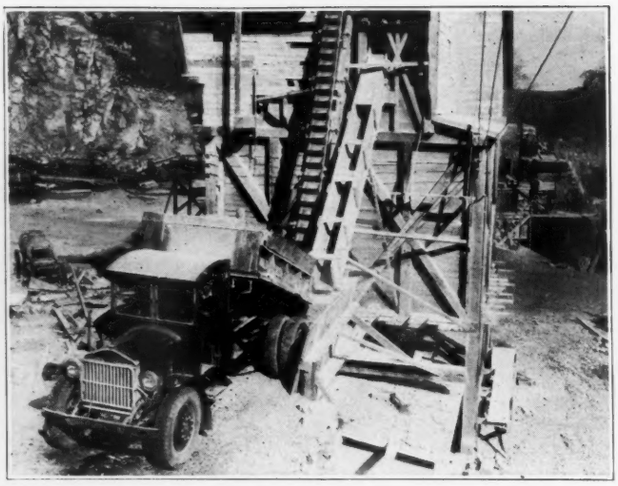




Car-loading bins (*left*); batching equipment (*right*), used to supply aggregates for local road work; and (*below*) stock-piling conveyor system from which a crane rehandles the material to cars.



The fine-crushing and screening plant with quarry face in background.



Truck discharging to cone crusher at fine-crushing and screening plant.

Erects Fine-Crushing Plant to Dispose of Smaller Sizes of Stone

Operator in Boston District Solves Problem of Finding Market for Material Under 1½ In.

ONE of the many problems connected with plant operation which are a continual source of worry to the operator, and a continual drain on the profit side of the ledger, is that of profitable disposal of waste materials. Almost every plant in the crushed-stone industry has such a problem so it becomes a matter of particular interest to other operators when one producer finds a solution.

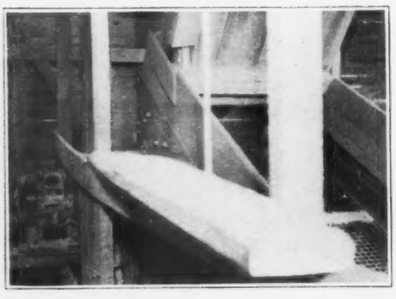
For many years crushed-stone plants in the vicinity of Boston, Mass., have been faced with the problem of disposing of sizes of stone ranging from 1½ in. down to pea stone. Specifications in this territory are such that there is very little demand for these sizes and, as a result, large quantities of potentially valuable stone have been and are going to waste.

The Malden Crushed Stone Co., one of the leading producers in this territory, faced this loss for a number of years and finally decided to settle its problem by the erection of a plant to reduce the waste materials to sizes for which there is a market, chiefly pea stone. Its new fine-crushing and screening plant was put into operation in August, 1931, and has already proved itself profitable.

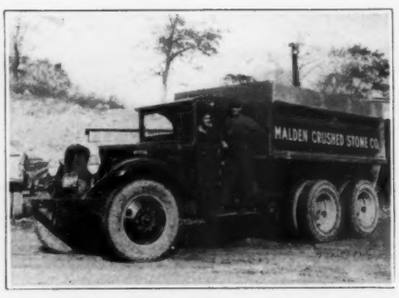
The operations of the Malden Crushed Stone Co. are located on the Newburyport Turnpike, Saugus, Mass., about 10 mi. north of downtown Boston. The quarry which supplies the stone was opened in 1922 when the original plant went into operation. The experience of the company, however, goes back considerably further than this, as M. McDonough, president of the company, has been active in the crushed-stone industry for over 40 yr. It is claimed that this company was the first in New England to use trucks for quarry haulage.

The deposit being quarried is the hard trap rock for which this section of the state is noted. The stone has a toughness of 22.5 and tests an average of 14.1 French coëfficient of wear. It is massive in formation with no seams, faults or cracks.

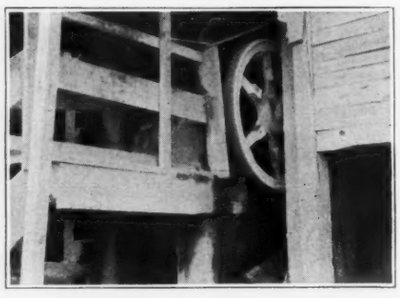
Overburden averages 2 ft. in depth and is removed during the winter by one of the quarry shovels and one of the trucks far enough in advance for the next year's operations. The quarry face is as much as 130 ft. high in some places. Due to



One of the two double-deck vibrating screens.



A 15-ton delivery truck with 10 pneumatic tires.



One of the jaw crushers used in the old plant.

Tractor dump wagon discharging to auxiliary plant.

the proximity of residences only small shots are made. Holes are drilled with Ingersoll-Rand Jackhamer and drifter drills. An average shot consists of 20 holes 22 to 30 ft. deep. Du Pont 75-per cent. dynamite and Cordeau-Bickford safety fuse are used. Little secondary shooting is necessary.

In spite of its hardness, the stone breaks down easily and the blasts bring down an average of 9 tons of stone to 1 lb. of dynamite. An additional 10 per cent. of dynamite is required for secondary shooting.

Stone is loaded by two Type 32 Marion 1½-cu.yd. steam shovels into trucks for haulage to the plant. Federal trucks with special wooden 5-cu.yd. bodies and individual hoists are used. These dump the rock at the main plant into the Farrel-Bacon 36-in. by 48-in. primary jaw crusher, which is driven by a 200-hp. motor. A series of belt-conveyors take the crushed stone to a scalping screen from which the "oversize" goes through a split chute to two Farrel-Bacon jaw crushers for further reduction. One of these is a 13-in. by 30-in. unit and the other a 13-in. by 24-in. machine.

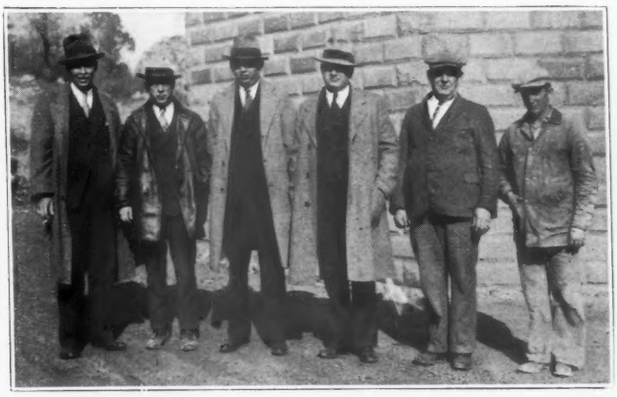
Material which passes through the scalping screen and the product of the secondary crushers are taken by a bucket-elevator to the top of the screening plant, where the stone is sized by three

Quarry crew with Carmen Frederico, quarry superintendent, at right. The shovel is one of two used for loading stone in the quarry.

rotary screens. Stone over 3 in. in size from the first of these screens is chuted to a 3-ft. Symons cone crusher for final reduction and is elevated back to the screens. The five sizes of material produced —3-in., 1½-in., ¾-in., ½-in., and dust—go directly to the 1,800-ton bin storage from which trucks are loaded for shipment.

The scalping screen mentioned above has a dust jacket with ½-in.-mesh wire cloth. Material passing through this jacket—pea stone—is loaded into trucks and dumped in storage piles across the highway from the plant. When there is a demand for this material it is reloaded into trucks for shipment by two Haiss stock-pile loaders.

Another small plant on the same property as the stock-piles is used when material is returned for any reason. The trucks dump to a hopper from which an elevator feeds to a small revolving screen. This produces the same five sizes of material as the main plant and stores them in five bins from which trucks can also be loaded. Material is also hauled



Left to right: W. A. Morrissey; John H. McDonough, president; Walter F. Delano, secretary; J. R. Clark, office manager; M. McDonough, treasurer; and Wm. McGrath, superintendent.

across the road to this plant from the main plant by a Hughes-Keenan 3-cu.yd. Iron Mule which is also used for cleaning up about the plants.

Sizes of which there is an excess supply are loaded into trucks at the old plant and hauled to the new plant with which this article is chiefly concerned. Trucks dump into a hopper feeding the Symons 2-ft. cone reduction crusher which is direct-driven by a 35-hp. G. E. motor. The crusher reduces the material to ½ in. or ⅜ in. and under as desired and discharges to a 65-ft. bucket-elevator, which feeds to a Niagara 3-ft. by 8-ft. double-deck vibrating screen with ¾-in. cloth on the top deck and ½-in. on the bottom. Material over ¾ in. is chuted back to the crusher for further reduction and that retained on the ½-in. deck goes to storage. The material passing through the lower deck goes to a second Niagara screen similar to the first except that it has ⅜-in. and ¼-in. cloth on its decks. All the three sizes produced by this screen go direct to bin storage, the four timber bins having a total capacity of 600 tons and load directly into trucks for shipment.

All shipments from the plants are made by trucks, as the radius of distribution of the plant

(Continued on page 62)

Factors Governing the Establishment of Compensation-Insurance Rates*

By G. V. FULLER
Asst. Sec., National Council on Compensation Insurance

THE purpose of workmen's compensation insurance is to guarantee monetary compensation to employees in industry for injuries sustained by them through accidents in the course of their employment. Accident cost in terms of such monetary compensation, varies from industry to industry according to the operations conducted by such industries. Naturally, one would not expect that a shirt factory would produce as great an accident cost as a quarry. Obviously, therefore, compensation-insurance rates, which are in fact indices of accident cost per unit of exposure, will not be uniform from industry to industry. It happens that the most satisfactory unit of exposure for compensation-insurance purposes is pay-roll and, therefore, our compensation rates are really indices of accident cost per $100 of pay-roll.

The first step, therefore, is to develop a series of industrial classifications to which all risks may be assigned, each classification being intended for a reasonably homogeneous group of risks. The practicability of application governs the number of such classifications. While an excessively limited number of classifications unquestionably would permit the development of a very reliable average rate for each classification, due to the greater volume of data that could be collected in each class, it would not be possible with too few classifications to assign rates to individual risks which would be sufficiently variant to fairly reflect the hazards of such risks. Conversely, an excessive number of classifications would not permit the consolidation of enough accident-cost experience under any one classification to make it possible to develop a reliable or reasonably stable rate for such classification. The Compensation Manual now contains about 700 industrial classifications, with a certain few state special classes in addition to provide for industries characteristic of such stakes only. The Classification Manual is under constant scrutiny in order to keep the classifications in step with changes in industry.

A compensation-insurance rate is actually the ratio of accident cost to exposure and is quoted in practice as the premium charge per $100 of pay-roll. Compensation benefits are not the same in any two states, so that insurance rates must vary statewise in accordance with the compensation laws of the various states. In general, however, the rates for the various individual states are determined in the same manner and from the same general type of statistical data. These data consist of the past experience of the insurance carriers, reported either directly or indirectly to the council by means of what is termed "Schedule Z." Under this system each carrier annually reports for each classification its insured pay-roll, which is the measure of exposure subject to accident cost; and the actual incurred monetary loss, which is the actual accident cost to the carrier under all its policies issued during that particular year. The reports of the individual carriers are correlated by state, policy year, and classification so that not only do we have a large number of data available in the aggregate but these data can be segregated as desired for use in the various steps involved in rate making.

It is obvious that a compensation rate is a direct reflection of the actual incurred accident cost sustained by the insurance companies in the coverage of a particular industry and it is important to note that the accident cost in other industries has little bearing or influence upon the rate for such industry. In other words, the rate for the quarry industry, for example, is not appreciably affected by the accident costs of other industries but is a positive result of its own accidents. It, therefore, lies within the power of any industry to create a favorable rate by reducing injuries to its employees by effective accident-prevention work. The nation-wide activities of an industry toward reducing accident cost affect the compensation-insurance rates for every state in proportion to the extent that the national experience is used in the determination of the rates in individual states. At this time it is important to stress the fact that while the national council develops rates, it does not make them. The industries themselves make their own rates by the accidents that are permitted to occur and recur in such industries. If an industry wants lower compensation rates, it must make them itself by all means at its command, particularly through the prevention of accidents and the lowering of accident cost. Accident prevention, therefore, has a distinct and very definite bearing upon compensation rates. If the various industries can reduce their accident costs, the insurance companies through the council, can then develop lower rates from improved experience which the industries themselves have made.

Actual rate making for a particular state consists, first, in determining what is termed the "state rate level," that is, the total premium required to meet the expected cost of compensation for injuries sustained by workmen in the state during the period in which such rates are to be in effect, plus the expense of conducting the insurance business during that period; and, second, the apportionment of the total state premium to the various classifications in proportion to their respective hazards, or, in other words, the establishment of what is termed the "classification rate relativity."

* Abstract of an address delivered at the 1931 National Safety Congress.

"State rate level" plays a very important part in the determination of rates for any particular state. When we develop rates for an individual state, such rates must provide that the accident cost sustained in that state, plus the cost of conducting the insurance business, will be covered by the collected premium based upon such rates. The accident cost in other states does not enter into the picture in the determination of the "state rate level." In other words, a certain definite amount of money in the form of premium must be collected in each individual state to cover its own accident cost exclusively. Of course, we might charge all industries a uniform rate determined so that, when applied to the exposure in each industry, the premium income in the aggregate would just equal that needed to meet all accident costs. Obviously, this would be unfair, because as previously stated, some industries are much more hazardous than other industries and are responsible for a much larger proportion of the total accident cost in the state. Therefore, rates must vary by industry on the basis of their relative hazards or, in other words, we must apportion the total state premium necessary to pay the total state losses on the basis of industrial hazard relativity.

The determination of "state rate level" and "classification rate relativity" in connection with compensation insurance can be compared for illustration with the determination of real-estate taxes in a municipality, for there is a very striking analogy. Our "state rate level" corresponds with the aggregate amount of money needed by the municipality for administration, improvement and like expenses, and our "classification rate relativity" corresponds with the tax assessments on the individual property owners as based upon their property valuations involving size of plot, location, improvements, and other appraisal items.

Each year in accordance with the provisions of the statistical rules known as "Schedule Z," the insurance carriers furnish the national council with a report of their most recent experience available. This experience is reported upon what is called a policy-year basis which differs from a reporting which might be made on a calendar-year basis in that a particular policy-year's experience actually covers two calendar years. For example, a policy written to be effective on the last day of a particular calendar year is in effect all through the following year; whereas a policy written to be effective on the first day of the calendar year is in effect throughout the calendar year itself. This policy-year procedure is necessary to permit the accident cost sustained on all policies issued during a calendar year to be compared with the actual premium collected on those same policies. This is essential in obtaining the actual "loss ratio" of any particular year's insurance writings. The data for the previous years are already on file with the council and are readily available for combination with the latest experience.

In general, the data reported by each carrier are in the aggregate by classification and are in the form of actual pay-rolls, actual premiums collected at the manual or adjusted rates existent during the particular policy year of coverage and the actual incurred accident costs, meaning the amounts already paid and those outstanding because of the deferred-payment provisions of the compensation laws.

With this—what might be considered as "raw" data or, in other words, the original reporting of premium and losses as they actually existed—it is possible to determine a loss ratio for each policy year, showing the ratio of the actual accident costs to collected premiums. While "raw" loss ratios are interesting for purposes of general information, they are not particularly applicable in our rate-making process because they are not comparable one to the other.

Over the several years there have usually been certain changes in the state compensation act or other changes have occurred outside accident frequency itself which have materially affected compensation costs. The act may have been liberalized in one way or another; the authorities, upon whose judgment the amount of the awards for compensation are dependent, for economic, or for other reasons may have become more liberal; a general increase may have occurred in the fees for hospitals, doctors and nurses or other medical attention for the injured; and other changes of less importance may be cited as examples of changed conditions which may have affected accident costs. It is apparent, therefore, that the annual experience as reported by the carriers can not be used "raw," but must be adjusted so that the experience for the individual years used in the process is on a common basis. Since the rates which are to be determined are intended to compensate for the accident cost which will develop on the basis of the compensation act and the general conditions existing at the time of determining such rates, it is logical to use the so-called "present law level" as the common basis for the accident-cost data. Since the indemnity cost is principally affected by changes in the compensation act of the state, the indemnity experience reported for each year is projected to the "present law level" by applying "amendment factors," which represent the difference in cost between settling the same cases under the old and present acts. On the other hand, while medical cost may be slightly affected by changes in the act, by far the greater effect is caused by the increasing cost of medical attention. Therefore, we key the medical cost to the level which may be expected to obtain during the year in which the rates are effective, as disclosed by the trend of the past medical costs.

As in the case of the "raw" accident cost actually sustained by the carriers during the various years, the premium during the same period of years is usually not collected on the basis of the same conditions. Changes in manual rates have usually occurred so that the amount of premium that was collected in an earlier year, for example, would not be the same in amount as would be collected at the present time for the same pay-roll exposure. We

have projected the accident cost to a common basis which is represented by the "present law level"; so we must likewise project our actual collected premium for the various years to a corresponding common basis, which obviously would be that of the present manual rates. To determine the "collectible premium," which is the premium that would have been collected in the past if the present manual rates had been applicable at that time, we use as a basis the state pay-rolls for each year of the experience and the manual rates now in effect.

With both losses and premiums for all years of the experience on a common level we can now determine the expected loss ratio for the period to be covered by the new rates as predicated on the state's own past experience.

It is important, first, to understand the term "permissible loss ratio," as applied in connection with compensation insurance. Compensation insurance rates provide for two contingencies: first and foremost, the payment of accident cost which is expected during the year the rates are in effect; and, second, the reimbursement to the carriers for the expenses of operating their organizations during the same period. The standard rate-making program of the national council normally contemplates that 60 per cent. of the total premium collected under a given set of rates shall cover the accident cost and the balance, or 40 per cent. of the total premium collected shall go to meet the expenses of conducting the insurance business; such expenses being acquisition cost, taxes, and the expenses involved in claim adjustment, inspection and accident prevention, pay-roll auditing and general administration. These percentages vary slightly from state to state due to differences in the tax requirements of the various states and also due to differences in the method of collecting the expense portion of the rates. The "permissible loss ratio," therefore, is that ratio of accident cost to collected premium, which must be maintained in order that the insurance carriers may "break even" and, as previously stated, such permissible loss ratio under the standard rate-making procedure is 60 per cent.

We do not express our loss ratios in terms of dollars rather than percentage because, while past experience shows accident cost per dollar of premium under a perfectly definite condition, there is no way of knowing whether future changes in exposure which will upset the proper relationship between premiums and accident costs will occur. If we used past aggregate losses as a basis, then the industries would pay more than they should for their coverage if the exposure were to increase; while, conversely, a decrease in exposure would penalize the carriers. Since percentage maintains a constant relationship of premium to losses irrespective of exposure changes, it is obvious that the percentage loss ratio is the fairest to all concerned.

The standard rate-making program of the national council provides that the rates for a particular state shall be predicated upon the basis of the three largest available years of experience sustained by the carriers in such state. In other words, any future set of rates shall be based upon the level indicated by the average of the loss ratios for the three latest available years of state experience. When the present rate-making plan was devised, judgment prompted the selection of the three latest years of state experience as a criterion of the state rate level. It was then expected that the number of data represented by three years of state experience would be enough in practically every state to produce an entirely reliable average loss ratio and the period would not be so long that it would be unresponsive to changes in accident cost conditions, nor so short that it would permit violent fluctuations in the level of rates from year to year. It was also the opinion that it would be sufficiently close to the period in which the rates were to apply that it would guarantee a reasonably prompt reflection of the most recent trend in accident costs in the state. However, while we still employ the three latest available years of state experience for the determination of the state rate level, it is not entirely satisfactory because it is actually failing to reflect the steadily-increasing trend of accident costs.

The determination of whether the present rates in a state are in need of revision and, if so, the extent of such revision, is made by means of a comparison of the loss ratio reflected by the average of the three latest available years of state experience and the "permissible loss ratio." In other words, the change in the rate level expressed in percentage is calculated by dividing the loss ratio of the three latest available years of state experience by the permissible loss ratio.

If in the previous steps we have found that the existing rates are not adequate to meet the aggregate expected losses, it may be that only a few locally important classifications are responsible for the shortage. If our determined rate level indicates that existing rates are excessive, maybe the rates on a few principal classes are too high. Even though the state rate level is just right, upon investigation we may find that the rates for certain individual classifications are too low, while those for certain others are too high, the effect being a neutralization of the discrepancies. It is the purpose in determining classification rate relativity to correct these conditions. To amend all rates by a flat percentage would produce the appropriate aggregate premium, but the inequitable relativity from industry to industry would still persist.

Even in determining classification-rate relativity for a given state we want to pay as much attention to the state experience as possible, because of state peculiarities that may exist in the various industries, but unfortunately all individual classifications applicable within the state will not produce sufficient data to permit an accurate comparison for hazard relativity determination even though we use more than three years of experience. For example, the quarry industry in Indiana is very important, and the volume of quarry experience in that state is enough to indicate its proper level in comparison with the aggregate. In Louisiana this is not true, but yet quarry rates must be provided for Louis-

iana as well as Indiana. If only three years of experience were used, as in the case of determining the state rate level, there would be very few classifications in a state that would produce enough experience to indicate their proper hazard relativity. For that reason five years of experience is used for relativity purposes—the five years' experience, of course, being adjusted to the same level as the three years' data used in connection with the determination of the state rate level. Five years of experience satisfactorily reflects changes in hazard, but it also prevents excessive fluctuations of the individual classification rates from year to year. Even with five years of state experience there are not enough data in many classifications to reflect their proper hazard relativity. This is where national experience or, in other words, the combination of all states' experience, enters our calculations. Here again we use five years of national experience wherein the experience for each of the various states is placed upon a common level so that their data may be properly combined and further adjusted to the state rate level.

As previously stated, an industry in a certain state may be affected rate-wise by the corresponding operations in other states and the smaller the industry in an individual state, the greater is the effect of the national experience. Now just how important must an industry be in a state to justify accepting its exclusive experience as a reliable indication of its own rate relativity? At this step actuarial and underwriting judgment has prompted the setting up of an arbitrary criterion. In the past several methods have been used as a guide. In a classification where accidents are numerous, the law of average comes more accurately into play than in one where the accidents are infrequent, even though the pay-roll exposures may be identical. We can not use a definite amount of accident cost exclusively as a criterion because that system would permit a classification with a high loss-cost to have full credibility but not a classification with a low loss-cost.

A combination of both exposure and accident cost is really what is required, so our criterion is based upon what is termed the "expected losses" for the state. By "expected losses" we mean the amount of accident cost that would occur in the state if the national hazard relativity were duplicated in the state's own data. Assuming that the state does not produce enough experience to be fully indicative, it is logical to expect that the national data will produce a more reliable approximation of a classification's relative hazard than will the state's own data for such a class. We determine each classification's expected losses by multiplying the state's classification pay-rolls for the latest five years by the corresponding national accident cost for such classification or, in other words, by what is termed the "national classification pure premium" which has already been converted to the state level of cost as previously stated.

The "pure premium" for any classification is that portion of each dollar of premium which is intended to cover accident cost exclusively and is actually the ratio of accident cost per $100 of pay-roll.

Now, it is apparent that in some industries the accident cost is primarily due to infrequent costly accidents, while in others the accident cost is due to frequent but relatively low-cost cases. Applying our expected loss criterion in one step, therefore, would not permit the feature of accident severity in the experience to be sufficiently reflected in the classification rates. Therefore, we have set up three divisions in both the state and national classification experience, *i.e.*, "serious" indemnity costs, including fatal, permanent total and major permanent partial cases; "non-serious" indemnity costs, including minor permanent partial and temporary cases; and "medical" costs covering all payments for medical services whether in connection with an indemnity case or not. A different expected loss criterion must be applied to each one of these parts of each classification's experience to determine the amount of credibility which the state's own experience is to receive in the final rate.

Our criterion provides, that if the expected serious losses for a classification equal or exceed an amount which is 25 times the average state cost of a serious case, the serious portion of the state rate shall be based exclusively on the state experience. If the non-serious losses equal or exceed 300 times the average state cost of a non-serious case, the non-serious portion of the state rate is based on state experience alone. And if the medical expected losses are at least 80 per cent. of the non-serious expected losses, the medical portion of the state rate is based on state experience alone. If the volume of the state expected losses for a classification does not qualify its experience for full credibility, we still allow the state experience to influence the rate in proportion to the amount of expected state losses as compared with the criterion for full credibility. For example, if the serious expected losses for a classification are between 75 per cent. and 100 per cent. of the amount required for full credibility, then the serious portion of the rate is determined by using 75 per cent. of the state experience and 25 per cent. of the national; if it is between 50 per cent. and 75 per cent., half the national and half the state experience issued; if between 25 per cent. and 50 per cent., then the state experience to the extent of 25 per cent. is used and the national experience used amounts to 75 per cent. Below 25 per cent. the state experience receives no credibility and the classification-rate relativity is determined on the basis of national experience only. The same procedure applies to the non-serious and medical portions of the rate. The results of this weighting process are called classification "state formula pure premiums."

Now, if the state formula pure premiums could be used to determine the rate for every classification our process would be a simple matter from here on. Frequently, however, other conditions exist in connection with the experience of a classification which

properly prompt a pure premium which is a deviation from formula. It is necessary, therefore, to review the individual experience for every classification which is granted any degree of state credibility and to select the proper pure premium for each one. The individual classifications with no state credibility are not reviewed but national pure premiums are adopted for them without further question.

We have now selected all the classification state pure premiums so that they reflect their proper hazard relativity. A test is now made, using these pure premiums so that they reflect their proper haz- in the rate level years to prove that rates based upon such pure premiums will produce the aggregate premium indicated in our determination of state rate level as needed to pay the state losses. Of course, if our test indicated a radical shortage or redundancy in the aggregrate premium resulting from the selected pure premiums, we could apply a flat factor to all the state classification pure premiums to bring them exactly into line in the aggregate, but this flat adjustment would not affect the classification state rate relativity in any way. We find, however, in actual practice that such an adjustment is not required, due to the care taken in the selection of state pure premiums.

We now uniformly increase these final classification state pure premiums to provide in the rates for the expenses of conducting the insurance business in the state. Our last step is to add one cent to the amount thus obtained in order to spread the expected cost of catastrophes over all industries, and we produce thereby the manual rates.

As the term implies, the "merit rating plans" provide for varying the manual rate on the basis of the merits of the individual risks themselves as measured by their physical conditions and their accident-cost history. It would be no fairer to require all individual risks within a classification to take the same manual rate than it would be to require all industries to take the same manual rate. Recognition of variations in physical conditions from risk to risk is given by means of what is known as the "Industrial Compensation Rating Schedule." Determination of the future relative hazards of the individual risks as based upon their past experience is accomplished by what is called the "Industrial Experience Rating Plan." In the Schedule Rating Plan, which applies only in connection with certain manufacturing classifications, we compare the physical conditions of the individual risk, as determined by an actual inspection of the properties, with the average for its particular industry and if it is physically poorer than the average, the manual rate is increased, while if physically better than the average, the manual rate is reduced. In the Experience Rating Plan, which on the other hand, applies in connection with all classifications, we compare the past experience of the individual risk with the normal experience expected for such risk and the manual rate is increased or decreased according to whether the risk's individual past experience is better or worse than the average.

I want to stress the three salient points of this address because they are vitally important not only to this industry but to every industry, and by understanding them the relationship of this congress to the matter of workmen's compensation rates will be better understood. First, the "state rate level" or in other words, the aggregate amount of premium which must be paid by all industries within a given state for their compensation insurance, is dependent entirely upon the state's own accident costs which have been paid by the insurance carriers. Second, the "classification rate relativity," or in other words, the distribution of the aggregate state premium among the various industries in the state, is in proportion to the individual industries' own accident costs. And third, the "individual risk rates" are, in a major degree, dependent upon the accident costs which have been sustained by the carriers in the coverage of the individual risks themselves.

Erects New Fine-Crushing Plant

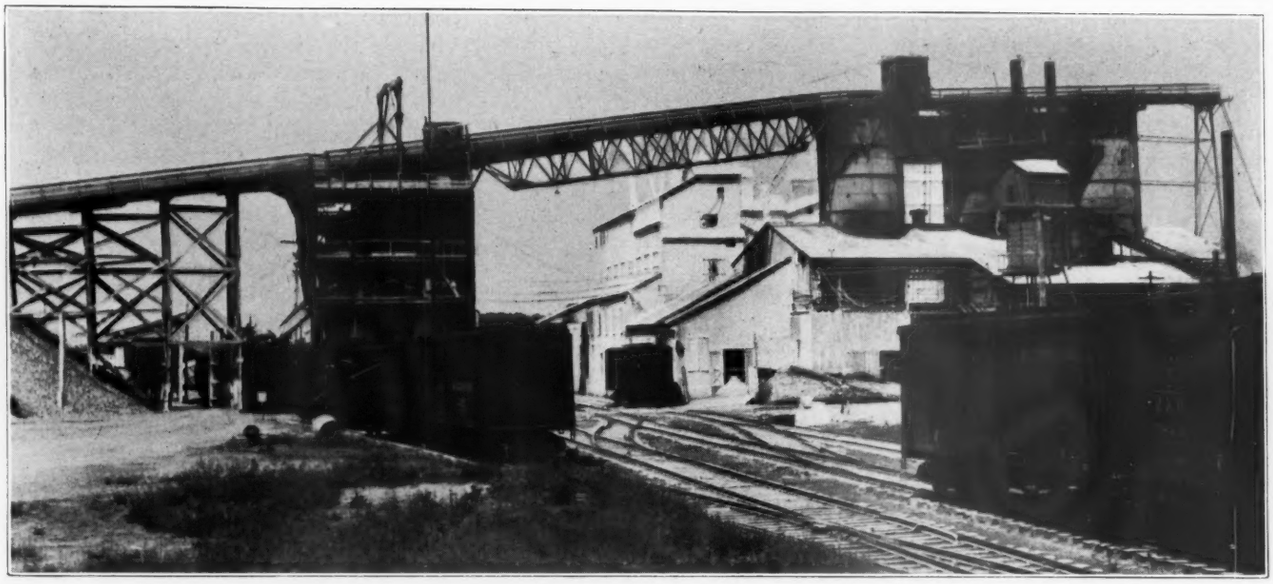
(*Continued from page 57*)

is necessarily confined to a comparatively small territory due to the large local demand and the intense competition in the metropolitan area of Boston. Shipments are made within a radius of 35 mi. In addition to the trucks used for quarry haulage the company owns 66 trucks, mostly of Sterling manufacture, ranging in capacity from 3½ to 15 tons. The most recent addition to the truck fleet is a 15-ton Sterling truck with four dual-pneumatic rear wheels and an all-steel body. These are used throughout the greater part of the year, but during busy seasons it is often necessary to hire as many as 35 additional trucks to meet the demand. During such seasons the trucks travel an average of 300 mi. per day each. Shipments are weighed on a 20-ton Fairbanks truck scale at the office near the plant.

A garage on the property has space for at least 30 machines. It also houses a blacksmith and repair shop, where most of the truck and plant-equipment repairs are made.

The new plant was designed by the company in conjunction with Earl C. Bacon, Inc., engineers and manufacturers of Farrel-Bacon crushers and other plant equipment, and distributors of Niagara screens. This firm furnished all the equipment for the new unit with the exception of the Symons cone crusher and also furnished the crusher and other equipment for the old plant when it was built.

The Malden Crushed Stone Co. has now completed plans for building a new plant to replace the original unit to be in operation in the spring of 1932. The same primary crusher will be used, two new secondary jaw crushers will replace those now in service, and six vibrating screens will replace the present rotary screens. Belt-conveyors will be used in place of bucket-elevators. The new unit will have a capacity of 200 tons per hr.



Inclined trestle which is used to charge the lime kilns at right. The primary crushing plant is at the left below the incline. Hydrating plant in background.

North American Cement Co. Also Markets Variety of Limestone Products

Three Steel-Shell Lime Kilns in Plant at Berkeley, W. Va., Burn Producer Gas

By M. F. BEISBER

IN addition to its well-known brands of cement, the North American Cement Co. offers a series of limestone products to its trade, among them being lump lime, hydrated lime, crushed stone, and pulverized limestone. These products are manufactured at the company's Berkeley plant which is located near Martinsburg, W. Va. Here a modern producer-gas-fired lime plant is operated, representing the best of its type in the Southeast.

There are three steel-shell kilns in the plant, each served by an individual producer-gas unit. The kilns have an exterior diameter of 20 ft. and are 40, 42, and 46 ft. high above the firing floor in order from the plant incline. The kilns have a 16-ft. interior diameter and are lined with fire brick; their firing zones are rectangular in construction, being 16 ft. long and 5 ft. 6 in. wide. Each zone is lined with a special fire-brick, and is fired from the two 16-ft. sides, there being four gas-ports to a side. Lime is drawn from a cooling zone located beneath the fire-zone level, the lime being received on a Link-Belt 36-in. pan-conveyor extended between the kiln column-supports.

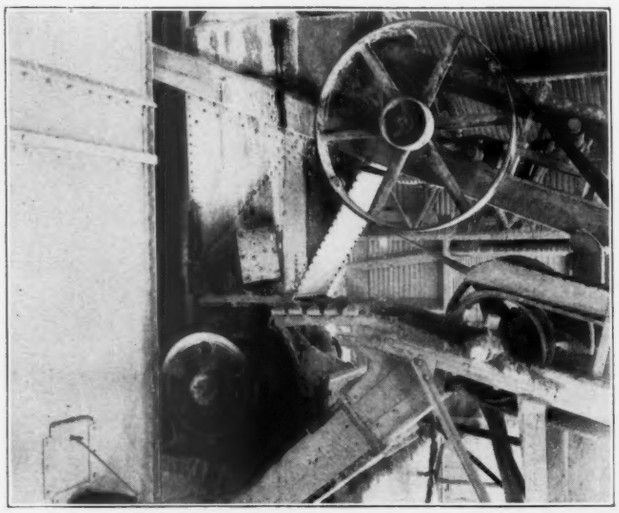
The three producer-gas units were built by the R. D. Wood Co., Philadelphia, Pa., which also designed and built the kilns. These units are of standard construction, equipped with Chapman Engineering Co. agitators and the usual automatic cylinder-type feeders. Coal is supplied to the feeders from an overhead bin. The producer gas is delivered to the kilns through ducts by a 72-in. Sturtevant fan. Steam is blown into the kilns with the gas as a means of maintaining a moist fuel, which, through better burning, produces a better-quality lime. A burning temperature between 1,280 deg. and 1,320 deg. is maintained. The average daily production is 150 tons, or 50 tons per kiln per 24 hr.

Limestone for the kilns and for the crushed-stone plant is produced in either of two quarries, the rock being of the same strata. Only one of the quarries is being worked at the present time, however. The two quarries adjoin each other, being almost one rectangular-shaped hole save for a narrow county road which divides them. A tunnel through the roadway connects the two quarries at their floor levels, and one of the industrial-railway systems which transports the rock to the plant passes through this tunnel.

The deposit is of a peculiar geologic formation, in that the strata are upset to a nearly-vertical position. Rock suitable for lime burning is taken out of a space approximately 200 ft. wide, one wall of the cut being the natural surface of the succeeding stratum. The quarry is worked in two levels, one being an 81-ft. ledge and the other a 24-ft. ledge. The latter is the upper ledge and has been worked several hundred feet in advance of the lower one.

Standard 6-in. blast holes, drilled on 20-ft. centers by a Loomis Clipper drilling-machine, are em-

ployed for the blasting of the 81-ft. ledge. These holes are drilled to a depth of 84 ft. and usually carry 20-ft. burdens. Each is loaded with about 2½ boxes of Atlas 40-per cent. dynamite in the bottom and about one-half box at a point about 25 ft. below the top. The dynamite is detonated by Cordeau-Bickford fuse. A recent 24,000-ton blast



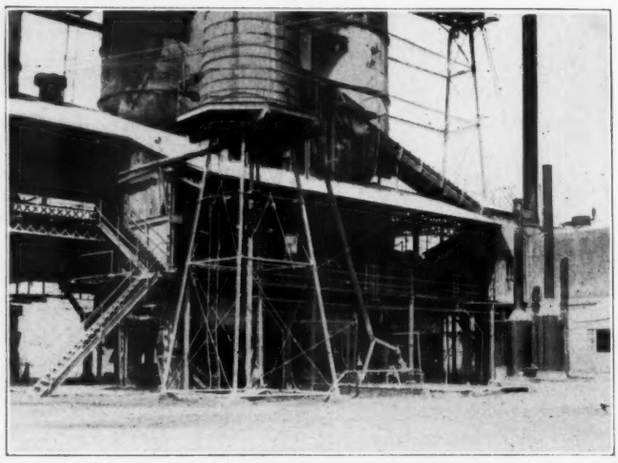
Crusher installation for lump lime.

required but 3,800 lb. of dynamite. The company's blasting average has been 5½ tons of rock per lb. of dynamite.

Blasted rock from the lower ledge is loaded by hand into Koppel cars, which have access to the blasted rock by means of a fan-shaped system of tracks. The track system comprises eleven spurs terminating in a single track which leads through the tunnel to an incline in the north quarry. This incline is used to haul the cars to ground-level before they are taken to the kilns by a long plant-incline.

The upper level of the quarry is a complete operation within itself. Separate drilling equipment is employed and the level is served by its own cars and car-incline. From the latter the cars are sent by gravity to the foot of the plant-incline, where they are rehandled to the kilns or to the crushed-stone plant as needed.

Adjoining the plant-incline is the primary-crushing-and-screening department of the crushed-stone plant. Cars of stone intended for this department are drawn about half way up the kiln-incline and at this point track-hoppers are provided to receive the stone. Because of the large average size of the stone, the track-hoppers discharge directly to a Kennedy No. 9 primary crusher for reduction to a maximum size of 4 in. The stone is then sent to a 16-ft. revolving screen which separates the plus-2½-in. and the "oversize," sending the latter to two secondary gyratory-type crushers for further reduction. The scalping-screen "throughs" and the secondary crushers' discharge are combined on a

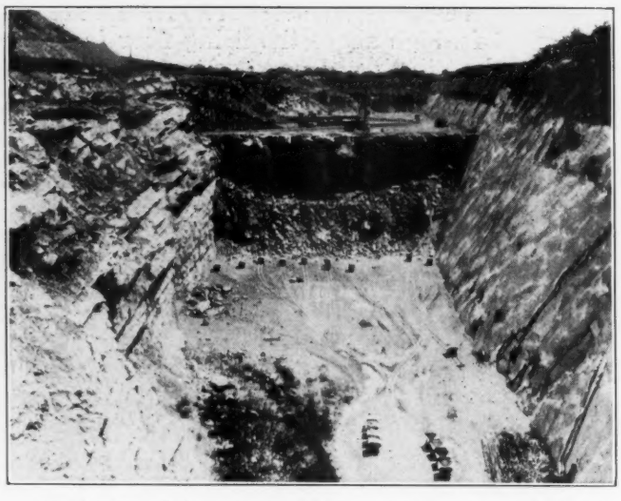


Producer-gas units and, at right, the boiler plant.

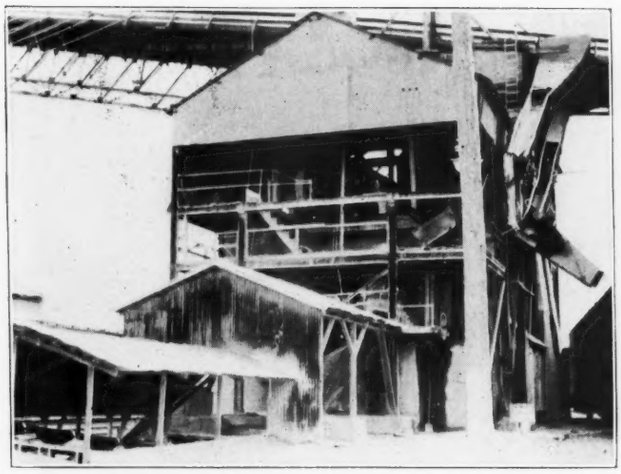
24-in. inclined conveyor leading to the screening-and-loading plant.

While not elaborate, the screening-and-loading plant is adequately equipped for the production and storing of all commercial sizes of stone. It consists, roughly, of a massively-constructed concrete understructure which spans a car-loading track. Above this base are mounted five steel circular-shaped bins, each having an available capacity of 75 tons. Above the steel bins an inclosed structure houses

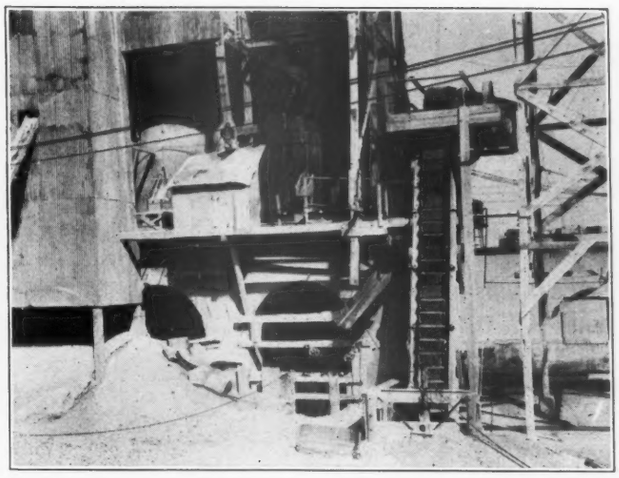
North portion of the quarry. Incline to plant starts at lower right.



South view of the quarry. Note operations on two levels.



Primary crusher beneath trestle leading to kilns.



Crushing plant with stock-piling scraper in foreground.

the screening equipment.

Material from the crushing-plant inclined conveyor is received in a Stephens-Adamson 5-ft. by 28-ft. jacketed revolving screen. This unit produces ¾-in., 1½-in., and 2½-in. materials. Plus-2½-in. stone is sent to another revolving screen for the separation of material which passes a 3-in. screen but is retained on a 2-in. screen. The minus-

View on the burning floor showing the gas ducts.

½-in. stone from the jacket of the first screen is sent to a Link-Belt 4-ft. by 5-ft. vibrating screen or direct to a bin. This vibrating screen produces ¼-in. to ½-in. stone and minus-¼-in. stone. Another Link-Belt vibrating screen, a 4-ft. by 10-ft. double-deck unit, is installed to receive and classify any size of stone. Its principal duty is the production of ¼-in. to ¾-in. stone. Oversize stone from the screening plant is recrushed by means of a Traylor No. 4½ recrusher, and a Kennedy No. 6 crusher, the crushed material being returned by an elevator to either the revolving screen or the 4-ft. by 10-ft. vibrating screen.

Adjacent to the five bins is a 24-in. belt-conveyor which gathers the excess materials for yard storage. A ¾-cu.-yd. Sauerman power drag-scraper, installed on a fan-shaped system of stock-piles, spreads the material out in long piles. When needed, the scraper is turned about and the materials are hauled to a bucket-elevator for their return through the screening plant. Cars are loaded by means of a 36-in. belt-conveyor mounted beneath the bins. Single grades or proportions of grades of stone can be made up on this belt, and trucks, as well as railroad cars, can be loaded from it.

For the agricultural-limestone and asphalt-paving markets, the company manufactures a pulverized limestone. Dust, or ¼-in. to ½-in. stone, is taken from its bin and sent through a 5-ft. by 30-ft. coal-fired rotary drier, whence it is then sent to a 15-ton storage-bin feeding two Fuller-Lehigh 33-in. mills. The finished pulverized limestone has a fineness of 95 per cent. through a 100-mesh screen and 83 per cent. through a 200-mesh screen. The

Discharge of pan-conveyor on the burning floor.

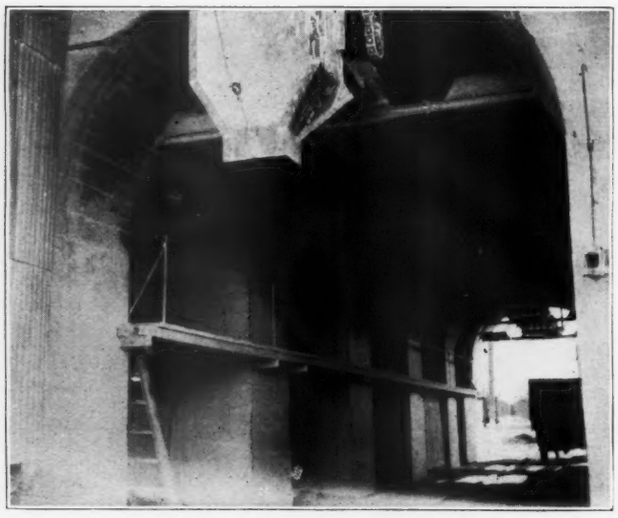
drier is driven by a 25-hp. motor and each of the two mills by a 50-hp. motor. The crushed-stone plant has a daily capacity of 700 tons and its production capacity for pulverized limestone is 30 tons per day.

Hydrated lime, one of the Berkeley plant's prin-

cipal products, is produced in a separate department adjoining the kilns. Here complete hydration, cooling and packing equipment is located, as well as large storage facilities for ground and hydrated lime. Lump lime from the pan-conveyor beneath the kilns is discharged over a dust-removing grizzly screen. The lumps are then transferred to a second conveyor leading to a Jeffrey 24-in. by 36-in. swing-hammer mill. The latter conveyor is a 24-

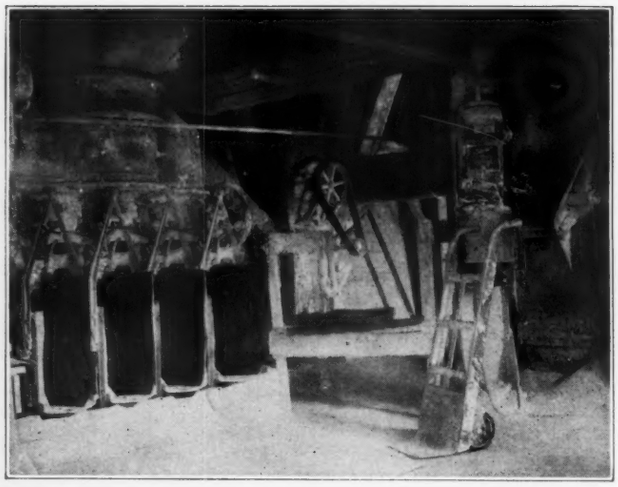
One of the pulverizers which produces ground stone.

in. belt-type of Robins manufacture. Lime reduced to ⅛ in. or less in size from the hammer-mill is delivered to a 1-760-ton storage-tank by a Link-Belt bucket-elevator and a series of screw-conveyors. A system of screw-conveyors beneath the tank recovers the material and returns it to the same



Car-loading tunnel for crushed stone.

elevator, which, in turn, delivers it to a Stedman 2-ton batch hydrator. After hydration the product is sent to a Reese Bros. 4½-ft. by 30-ft. rotary cooler where the heat of hydration is dissipated. Following this operation, the hydrated lime is elevated to a 10-ton aging or surge-tank over two Raymond automatic air-separation pulverizers. These units separate cores, unburned lime and other objectionable material from the finished product,



Packing machine and, at right, two pulverizers for hydrated lime.

the latter being sent to two 70-ton tanks over the sacking-machines. Four Bates packers place the hydrated lime in Bates Duplex sacks for shipment.

Hydra-Calcite, the by-product of the hydrating department, is made from the cores and unburned stone from the pulverized "rejects." This material is collected by a screw-conveyor from the pulverizers and is elevated to a 16-ton feed-tank over a tube-mill, or it is sent to a 2,000-ton steel storage-tank located adjacent to the ground-lime storage-tank. The tube-mill is an Allis-Chalmers 5-ft. by 22-ft. unit lined with Silex flint rock and loaded with 7 tons of ¾-in. and 1¼-in. steel balls. The ground Hydra-Calcite, which has a fineness of 92 per cent. through a 100-mesh screen, is elevated to a 120-ton tank. It is then packed in 80-lb. sacks by a Bates 4-tube packer. Bates Multi-Wall sacks are used for the shipment of this product.

Provisions are also made for the shipment of lump lime in car-load quantities as well as ground lime and pulverized limestone.

E. F. Alderton is local superintendent under E. S. Guth, southern district manager, in charge of all southern operations for the North American Cement Co.

Supt. E. F. Alderton and the plant safety monument.

A Comparison of Wire-Saw Operation in Europe and the United States*

By OLIVER BOWLES
Supervising Engineer, Bldg. Matls. Sec., U. S. Bureau of Mines

WIRE saws have been used for many years in European travertine, marble, and slate quarries. This method of sawing found very limited use in America until 1927, when it was accepted as standard equipment in slate quarries in Pennsylvania, where it has been remarkably successful. Details of its operation in slate have been published in a recent bureau report.[1]

The limited extent to which the wire saw has been employed in limestone and marble quarries in the United States and the seeming lack of interest even in experimental work to determine its advantages are difficult to explain in view of its wide use in cutting similar rocks in Europe and its unquestionable advantages in sawing slate in America. In order to encourage improvement in quarry practice the United States Bureau of Mines has endeavored to obtain information as to the extent to which wire saws are used in Europe, together with data on the rate and cost of sawing. The information at hand is by no means complete either in territory covered or in details of operation; it nevertheless brings out certain significant features that may be of interest and advantage to quarrymen in the United States.

The data regarding foreign practice were furnished principally by foreign service representatives of the Department of Commerce in response to a Bureau of Mines questionnaire transmitted through the courtesy of W. H. Rastall, chief of the industrial machinery division of the Bureau of Foreign and Domestic Commerce.

About 150 wire saws are in use in the famous Carrara marble quarries and about 20 in the travertine quarries at Tivoli near Rome. Travertine is a variety of limestone somewhat softer than marble. In the travertine quarries the rate of cutting as reported is about 5.4 sq. ft. (0.5 sq. m.) per hr., and the cost is about 20 c. per sq. ft. (40 lire per sq. m.). Carrara marble can not be sawed as rapidly as travertine, and the cost is probably higher. The wires used are three-strand steel cables which vary in diameter from 0.16 to 0.22 in. (4 to 5.5 mm.). Two types of wire are employed. For sawing in a quarry where accuracy is not demanded the wire is of the simple helicoidal type, that is, one in which the strands are twisted continuously in one direction. For sawing detached blocks of stone where accuracy in dimensions is required double-helicoidal wire is found to give best service. This type is made by twisting the strands in one direction for a certain length of the wire, and then reversing the twist, thus giving sections which are twisted alternately to right and left. Sand is used as abrasive in sawing both marble and travertine.

About 17 quarries are in operation in the marble district of southern France, which skirts the Pyrenees Mountains. Wire saws are used extensively both in quarries and mills, but the number has not been ascertained. One of the larger companies reports that the wire used by them for sawing amounts annually to several carloads of 10 tons each. The length of wire used for sawing in mills varies from 164 to 1,969 ft. (50 to 600 m.), and in the quarries from 2,625 ft. (800 m.) to several thousand feet. No data have been obtained on the rate of sawing. In the Nord district of northeastern France about 130 wire saws are in operation, chiefly among five companies. They are used only in the quarries, gang saws being employed for cutting blocks in the mills. The wire is 0.16 in. (4 mm.) in diameter. Sand is used as abrasive.

About 80 per cent. of the 42 marble and other calcareous-rock quarries of Belgium employ wire saws, but the number has not been obtained. They are used both for sawing in quarries and for cutting detached blocks. The rate of sawing in quarries varies from 4.3 to 5.4 sq. ft. (0.4 to 0.5 sq. m.) per hr. The cost of wire sawing in quarries is about 51 c. per sq. ft. (140 francs per sq. m.), while the cost of sawing detached blocks is about 29 c. per sq. ft. (80 francs per sq. m.). Information available is not sufficiently complete to indicate whether the costs given for sawing either in Belgium or in Italy are direct costs, or whether they include all overhead and indirect charges. Sand is used as abrasive.

No data have been obtained on the rate or cost of sawing slate in Europe.

It is interesting to compare the rates of sawing travertine and marble in Europe with the rate of cutting slate in Pennsylvania. That of Italian travertine as given above is 5.4 sq. ft. per hr., and of Belgian marble 4.3 to 5.4 sq. ft. per hr. In soft-vein slate in Pennsylvania, as recorded in the report of this bureau previously cited, the rate is 20 to 25 sq. ft. per hr. actual cutting time, or 14 to 17 sq. ft. per hr., allowing for all stops and delays. In hard-vein slate the rate is 10 to 12 sq. ft. per hr.

The cost of sawing in European quarries which varies from 20 c. per sq. ft. in travertine to 51 c. per sq. ft. in marble is contrasted with a total cost in Pennsylvania slate of 19 to 25 c. per sq. ft.

From the above data it would appear that marble and travertine are sawed much more slowly than slate. Several operators who have tried wire saws in marble quarries in the United States have become discouraged at the slow rate attained and have abandoned the method. Evidently, however, long years of experience in Europe have proved that

* Reprinted from U. S. Bureau of Mines Information Circular No. 6,483.

[1] Bowles, Oliver, *The Wire Saw in Slate Quarrying:* Tech. Paper 469, Bureau of Mines, 1930, 31 pp.

wire sawing is profitable even though the rate attained is only 4 or 5 sq. ft. per hr. Figures presented herein should therefore encourage American quarry operators to devote further efforts toward perfecting the process.

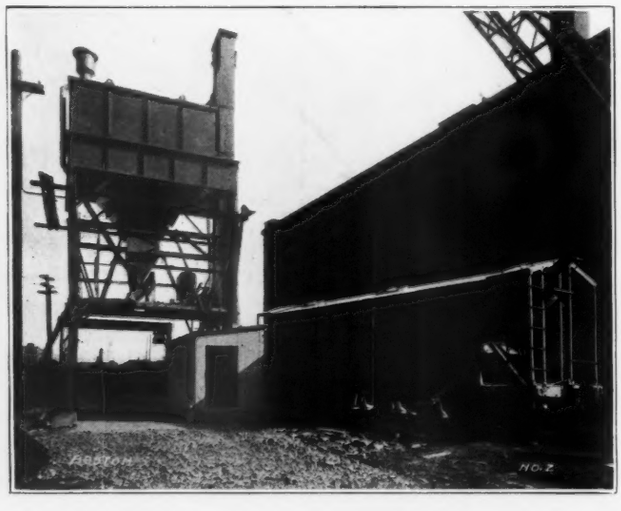
Even though preliminary tests show rates of only 1 or 2 sq. ft. per hr., attempts should not be abandoned without exhaustive experimental work, because increasing efficiency is usually attained by experience. It is noteworthy that in the first attempts to saw slate with a wire the rate attained was 9.7 sq. ft. per hr.; early the next year the average was 12.8, and in less than two years an average of 20 to 25 sq. ft. per hr. was attained. In other words, the earliest experimental rate of cutting was increased nearly threefold when methods and equipment were standardized.

Unquestionably much profitable experimental work could be done with a wire saw both in quarrying and in milling various types of structural and ornamental stone.

Boston Gravel Producer's Concrete Plant Has Novel Features

The new ready-mixed concrete plant of the Boston Sand & Gravel Co., which went into operation in July, 1931, has a number of features of interest to other operators. This plant is located on the same property as the company's original plant at 120 First St., Cambridge, Mass., but is an entirely distinct unit except in some of its materials-handling facilities. The original plant, which has been in operation about 2 years, has a capacity of 60 cu. yd. per hr. as compared to the new plant's capacity of 80 cu. yd. per hr.

Gravel and sand are brought in by barge from the company's gravel plant at Scituate, Mass., by way of the Charles River Basin and the Leechmere Canal. A traveling crane rehandles these materials to storage bins which have sufficient capacity to insure against any delays in delivery from this source. Trucks are loaded from these bins and discharged to a track hopper feeding a series of belt conveyors which deliver to both of the concrete plants.



Bulk-cement car at the storage-and-loading plant.

Special truck used to haul cement to the plant.

Most of the equipment for this plant, which is of conventional design, was furnished by the Blaw-Knox Co. This includes the bins, weighing batchers, bucket elevators, screw conveyors, truck bodies and other equipment. The concrete can be mixed in a 3-cu. yd. Ransome mixer or trucks may be loaded direct from the batchers for mixing in transit or at the job. Blaw-Knox, Jaeger and Clinton trucks are used.

The cement-handling system is of special interest. As the plant uses bulk cement and is about ½ mile from the nearest railroad siding some unusual means of transportation between these points had to be devised. The problem was solved by the construction of a truck similar to those used by the Huron Portland Cement Co. at Detroit but differing in some details. The truck has a capacity of 60 bbl. of cement and is mounted on two dual-pneumatic rear wheels. The front end is supported on a McCormick-Deering pneumatic-tired tractor and is detachable. This unit has a speed of 20 m.p.h. when loaded.

A small plant was erected at the railroad siding to unload the cement from cars into the truck. This plant consists of a 200-bbl. capacity steel storage bin and the necessary handling equipment. When cement is received in special Hercules bulk-cement cars, with which the cement industry is familiar, the cars discharge to two fully-enclosed screw conveyors alongside the track. These feed to a third screw conveyor at right angles to them which in turn feeds to a bucket elevator to bin storage. When the cement is received in box cars it is unloaded with a power scraper to the same screw conveyor and elevator. Loading into the truck is by gravity and is accomplished in two minutes.

Air jets in this bin prevent sticking of the cement when loading. The power scraper and screw conveyors are driven by a Le Roi gasoline engine and the elevator by an electric motor through speed reducer and chain. Blaw-Knox equipment is used throughout. The truck discharges to the cement-handling system at the plant through two unloading screws which discharge at the rear end of the truck. A Hercules gasoline engine drives these screws. Unloading takes about 15 minutes. This cement-handling system was put into operation in September, 1931, and has been entirely successful.

League of Nations Reviews World Cement Output as Depression Barometer

THE omnific investigations of the Economic Committee of the League of Nations have once again led to a survey of the world cement situation.

The last-issued report on World Production and Trade embraces the years 1925 to 1930. The percentage index for cement does not include Latin America or Africa. It is, however, sufficiently representative to afford a just appreciation of the growth of the industry in the regions to which they relate. These regions account for the bulk of world production.

The index as qualified by the League's Economic experts should not be employed as a measure of building activity. Between 1925 and 1929 the output increased at an average rate of a trifle more than 6 per cent. per annum but this rate was not maintained in 1930, according to the data available.

The following percentages represent values as current in 1925.

World Total 100 Per Cent. of Production Values

	1925	1926	1927	1928	1929
Europe, excluding U.S.S.R.	40.4	40.9	41.9	43.4	44.1
Europe, including U.S.S.R.	41.6	43.	44.3	46.1	47.3
North America	50.7	48.5	47.1	45.6	44.
Asia	6.5	7.3	7.3	6.9	7.4
Oceania	1.2	1.2	1.3	1.4	1.3

The total world values showed the following increases over the year before (taking 1925 values as a base) : in 1925, 0.9 per cent.; 1926, 1 per cent.; 1927, 1.1 per cent.; 1928, 1.1 per cent.; 1929, 1.1 per cent.

Weighted by 1929 values, the index of cement production throughout the world, taking 1925 at the base of 100, is shown to be 107 in 1926, 116 in 1927, 123 in 1928, and 124 in 1929. A general lowering of world prices is thus indicated, since the throw-back to the 1925 scale would have resulted in a 24 per cent. increase in value in 1929 figures had they been reckoned on the former base.

For the last two years for which figures are available the league tables show 1929 cement production throughout the world as being 71,700,000 metric tons, an increase of 1,100,000 tons from the year before.

The fact especially stands forth that the production of the U. S. S. R. increased 1,000,000 metric tons in the last four years, which is about the bulk increase credited to the United States for the same 4-yr. period, also to Great Britain and Germany, that of France running about even.

* * *

Coincident with discussion and debate as to the possibility of drawing up an international pact of economic non-aggression, submitted to the Economic Committee of the League of Nations by the U. S. S. R., a trade summary relating to 64 countries treats of many of the basic commodities in relation to the world economic depression.

Cement, as one of these elements, is believed to be a useful yard-stick for measuring a progressive prosperity. Post-war developments in the industry brought some surprises and the depression of the past two years has brought some others. Cement apparently has held up better than, for instance, wood-pulp, fuels, and minerals.

The greatest increase in the value of cement products is to the credit of Europe (including the U. S. S. R.) with an index of 141 (100 for 1925) as compared with North America 108, and 124 for the entire world.

European output still ranks in value by countries as follows: Germany, France, Italy, Belgium, the U. S. S. R., Poland, and Spain. Of world production, Europe accounts for 33,800,000 metric tons out of 72,000,000 tons as estimated by the league.

The production of the U. S. S. R. is set forth as follows, though as yet it is not reckoned as being a disturbing factor in international trade from the fact that needs within the country in carrying out the 5-yr. plan of industrial reconstruction are as great as they are. The same ratio of increase being continued, the opposite may sooner or later be the case.

Year	Production (*metric tons*)	Year	Production (*metric tons*)
1924	358,000	1927	1,599,000
1925	708,000	1928	1,902,000
1926	1,293,000	1929	2,290,000

The relative progression of output has been greater than with respect to any other country. Germany in the same period of years, however, has nearly doubled its production and Spain more than doubled its tonnage, as has Great Britain, France and Japan, China being apparently not a factor of importance, as it is included among "other Far Eastern countries" credited with 1,000,000 tons.

League statistics divide the world into six continental groups. The index number for the value of cement production is given as 100 for 1925. By 1930 world production had risen in value to 124, but this includes computations referring to at least six months of "boom" times.

The European group, including all countries but the U. S. S. R., registered 44.1 per cent. of the value of world output (including the U. S. S. R. which was 44 per cent.). The Asia group was 7.4 per cent., the Oceania group 1.3 per cent., and the North American group 44 per cent. This omits the Central and Latin American group, where the development of the cement industry has cut in considerably on the former export of American cement. Neither is the African group included to make a round 100. The Belgian Congo had, however, in 1929 a production of 160,000 metric tons and it is believed that with the French protectorates of Morocco and Tunisia (probably included in the figures applying to France as a whole), and including also Egypt, the annual output of Africa, is not far from 500,000 tons.

Safe Practices in Handling and Use of Explosives in Tunnel Driving*

By CHARLES S. HURTER, S. B.
Technical Representative, E. I. du Pont de Nemours & Co., Inc.

HANDLING and using explosives with safety in tunnel driving present a number of problems that differ somewhat from those encountered in mining. In tunneling it is customary to advance only one or two faces from each base of operations, according to whether the entry is made from a portal or a shaft. The work is therefore concentrated, and, if the rock is hard, the explosives will be used so rapidly that storage arrangements may be satisfactory which could not be tolerated at a mine, or even at a tunnel in easy ground, where the consumption of explosives is relatively slow. Moreover, the work is temporary. Whereas a mine can afford to build a permanent brick magazine according to recommended standards, the magazine for a tunnel project is generally abandoned and its cost written off when the job is finished. Consequently the cheapest type of magazine that will keep the explosives in proper condition until used is the practical type.

Sometimes a dug-out in the hillside covered with boards and soil, which would be most inadvisable as a mine or quarry magazine, will serve the purpose, though not recommended even at a tunnel. If the floor of such a dug-out or any other storage place for explosives is wet or damp, 2-in. by 4-in. timbers should be laid and the dynamite cases set on these. The timbers will not only keep the boxes out of direct contact with the damp floor but will also allow air to circulate beneath them.

For magazines built in the open, wooden construction with sand-filled bullet-proof walls is the most appropriate type. A few concerns use sectional steel magazines as they can be taken apart at the end of one job, moved to another and erected there or can be put in storage. These can be bullet-proofed by a sand-filled interior wall. Twelve inches of dry sand will stop the highest-power rifle bullet used for big game. Steel magazines that are exposed to hot summer sunshine should be painted with aluminum paint to keep down the inside temperature.

Dry, well-ventilated storage for explosives is the basic rule for keeping them in good condition and can be sacrificed without the risk of misfires and burning charges only when the explosives will be used quickly. The fact that the explosives employed in tunneling are generally of the gelatin or semi-gelatin type, which does not absorb moisture readily, also has some bearing on the kind of storage that is permissible. However, the very fact that quick use and the selection of a water-proof explosive may justify some variation from the rigid observance of the best practices renders it doubly important to make sure that all the explosives remaining from a previous shipment are used before starting on a fresh shipment. Always pull old stock forward in the magazine and store fresh stock behind it.

It is generally necessary to pay more attention to the storage of the detonators, that is, both the instantaneous and the delay electric blasting-caps, at a tunnel operation than to the dynamite. These are not ordered as often as the dynamite and, therefore, more care must be taken to keep them cool and dry so as to prevent deterioration.

Economy in tunnel driving depends upon continuity of operations at the face. The muck trains must be kept moving, the drilling must be continuous from start to finish, and the loading of the bore holes must proceed "without a hitch" as soon as the drills are removed from the face. Consequently, as an aid to expeditious loading, the common practice is to have the primers made up on the outside. This should never be done in the main explosives magazine. The best practice is to have a small special shelter house where the powder man can make the primers. The primers should be placed in a box equipped with a carrying handle and divided into numbered compartments, one for primers with instantaneous electric blasting-caps and one for each delay. Such a box greatly facilitates carrying primers, handling them at the face and getting the proper delays into the proper holes to give the desired rotation of shots. Putting a wrong delay in any bore hole is likely to result in one or more cut off holes with the accompanying danger of unexploded dynamite in unbottomed holes and in the broken rock, as well as often ruining the execution of the round.

It is best not to send the primers into the tunnel in the same car with the main stock of explosives, but in a separate car or on separate trips. A few concerns have a covered, insulated car made especially for transporting explosives and this is, of course, the safest method. Whatever the type of car used, it should be attached to the locomotive or to the preceding car by an insulated coupling. If an ordinary car is used and hauled by a trolley locomotive, it should be separated from this by two or three cars to prevent sparks from the trolley from falling on the explosives, or the explosives should be covered with an insulated, fire-resisting tarpaulin. It is also a wise precaution to have the bottom of the car body insulated from the tracks.

To prevent delay the dynamite and primers are usually taken into the tunnel before the drilling is finished and piled at one side until time for loading the holes. The spot for leaving the explosives during this interval should be chosen with some care. It should be on the side opposite the lighting wires,

* Reprinted from the *Du Pont Explosives Service Bulletin.*

pump cables and any other lines carrying electricity and the box of primers should be set at least 100 ft. from the main stock of dynamite. If the tunnel width permits, the explosives, especially the primers, should be placed far enough back from the track so that there will be no chance that a piece of rock may fall on them from a passing muck train. In all tunnels there are places where the muck cars are more likely to jump the tracks than others,—turnout switches, for instance, and neither dynamite cases nor primers should be left close to any such point. Once in a while a short tunnel driven from a central station uses an incline up which the muck cars are hauled instead of a shaft. In an operation of this kind the explosives should never be placed where a runaway trip of cars would be likely to smash into them.

Loading the holes requires the closest attention. The greatest hazard to which explosives can be subjected is grinding friction, particularly in the presence of grit. Therefore the holes should first be blown out with compressed air as clean as possible. Then, in tamping the charge, a short firm push of the tamping stick should be employed, never a long or violent stroke. The gelatins used to-day in tunnel driving are so soft, when in good condition, that they are easily compressed to fill the full diameter of the bore hole and every violent stroke tends to make an air pocket in the charge which will reduce its efficiency. Too long a stroke tends to smear the explosive along the sides of the bore hole and thus expose an excessive amount to a grinding action between the tamping stick and the sides of the hole. While this friction is less dangerous with a wooden rod than a metal or metal-tipped one and in a wet hole than a dry one, it is nevertheless present at all times and should not be forgotten in tamping the holes.

Primers should always be handled and loaded with the utmost care. One or two men, depending upon the size of the heading, should have charge of issuing the primers to the loaders, as called for, to insure placing the correct period of delay electric blasting cap in each hole.

All charges should be tightly confined, preferably with moist sand, clay or loam. This not only increases the efficiency of the explosive but also reduces the volume of noxious fumes after blasting. Care should be used in tamping to avoid damaging the electric blasting-cap wires.

If power current is available for firing the blasts, connecting the detonators in parallel will result in fewer misfires from electrical troubles, year in and year out, than connecting them in series. The simplest method of making parallel connections consists in stretching two No. 14 gauge bare copper wires across the face and connecting one leg of each cap to one of these buss wires, as they are called, and one to the other. In a large face more than one set of busses may be needed. In such case, the sets of busses should be connected in parallel to the main leading wires.

Sometimes, with a heading and bench, the lay-out is such that parallel connections are impractical. Under these circumstances a parallel series connection is recommended. If the holes in the face and bench can be connected in series groups with not more than 20 electric firing devices in a series, the possibility of misfires due to current leakage from the leg wires is reduced to the minimum. In fact, any division of the holes into parallel-series groups reduces the chances of misfires from this source. The only precaution is to make the division so that each group contains the same number of electric firing devices.

In all tunnels lighted by electricity, it is important to guard against the possibility of premature explosions due to stray currents. When the heading is lighted by electricity during loading, all wires should be kept away from the face and as far back as possible. In some tunnels this problem is solved by setting up a strong floodlight on the floor some distance back from the face.

The wires of the blasting circuit should always be kept on the side of the tunnel opposite from the lighting wires and any other wires carrying current. The main leading wires for the blasting circuit should be short-circuited at the firing switch until the time for firing, and this short should be kept out of contact with the ground, rails or pipes. This not only prevents any stray current from entering the blasting circuit through the bare wire ends but also affords an alternate low-resistance path for any stray current that might enter the circuit at other points instead of leaving only the one path through the electric blasting-caps in the face, as would be the case if the circuit were left open when the leading wires are connected at the face.

If carbide lights or torches are used to light the heading during loading, obviously care must be exercised to prevent the lights themselves, or sparks from them, from falling on the explosives. If electric flash lamps are used, they should be tested previously for safety. With some of these lights it has been found that, if one wire of an electric blasting-cap is placed on the switch while the current is turned on and the other on the metal base of the lamp, sufficient current will pass through the cap to fire it. No lamp which fires a cap on this test should be permitted for use in connection with electric blasting. At least one serious accidental explosion in a tunnel is believed to have been caused by an unsafe type of electric flash lamp.

Once in a while in blasting the cut a large boulder is thrown an excessive distance down the tunnel, occasionally doing some damage. Where this is likely to occur, drilling one or two buster holes in the cut is advised in order to make the rock break smaller.

A more frequent cause of accidents in tunnels, and generally serious accidents, is drilling into unexploded dynamite. It is of vital importance for the safety of the whole tunnel crew that before drilling is started in the face, all holes should be carefully examined by the heading boss or some other competent man to make absolutely sure that they do not contain any unexploded dynamite.

Of course every precaution should be taken in priming and loading the charge to prevent having unexploded dynamite left in the bottoms of the

holes. Occasionally this is due to compression of the explosives through the rock by the previous shots of a round. All explosives as taken from the mixer at the plant gain in sensitiveness with compression up to a certain point. When compressed beyond that point they decrease in sensitiveness very quickly. This fact is taken into consideration in cartridging explosives in order to assure just the degree of sensitivity, as well as the density, believed most desirable for each explosive. It is readily evident that in some types of rock the explosion of the earlier holes of a round of shots fired in rotation may compress the charge in the later holes sufficiently to result in incomplete detonation. If unexploded gelatin is found as a fairly regular thing after blasting, this is usually the cause.

In the old days when only instantaneous electric blasting-caps were used, the remedy for this trouble was, in loading each set of holes, to place a single primed cartridge in the bottom of each of the next set of holes and fire these along with the loaded holes to keep the next set of holes from being closed by the blast. To-day, with the prevailing practice of blasting the entire face in one shot by means of delay electric blasting-caps, the only remedy is to drill holes of larger diameter and to avoid packing the explosive too tightly in these holes. In compressible rock it is very important in loading the holes to have the business end of the detonator pointed toward the center of the charge.

Another closely-related source of accidents is striking unexploded dynamite in the broken rock. The loaders should always watch for this. It is more frequently found where the rock has slips and cracks, for the force of the explosion in one hole may then work back through a slip and cut off part of the charge, or even occasionally the entire charge, in a hole timed to explode later. This throws unexploded dynamite into the broken rock as well as leaving it in unbottomed holes. Under such conditions it is best to have the primer placed as deeply in the charge as possible, with the detonator always pointing toward the bulk of the charge. This at least reduces the chances of leaving unexploded dynamite in the bottoms of the holes.

Unexploded dynamite in unbottomed holes and in the broken rock is sometimes due to putting the wrong delays in the holes, thus causing them to fire out of order. Therefore the man assigned to pass the primers to the men loading the holes should be one who is competent and alert. In addition, after the holes are loaded the delays should be checked by reading the numbers on the tags attached to the leg wires. It is far easier to take every precaution in loading holes than to undo the results of drilling into unexploded dynamite in the face or of striking it in loading out the broken rock.

Whatever the explosive in use, it is unwise to return to the face immediately after a blast. Explosives can be made so that their gases upon detonation are not particularly poisonous, but it is impossible to make them so that these gases will sustain life. Therefore sufficient time for the heading to receive a supply of fresh air should always be allowed before going back. Especially important is it to refrain from rushing in too soon after the break-through blast. A well-balanced shot produces the minimum quantity of poisonous fumes, but when the final break-through between the headings is shot, the holes are almost invariably very heavily overloaded. The result is generally an excessive volume of poisonous fumes which render the customary rush to be the first man through somewhat dangerous. It would be much better if, just as soon as the direction of the air current is determined, the crew in the direction toward which the fumes are traveling, would retire and let the other crew finish the necessary blasting.

Production of Gypsum Falls Off in Third Quarter of Year

The accompanying table shows the result of a canvass by the United States Bureau of Mines, of the gypsum industry to show the quarterly production, imports, and sales of gypsum:

QUARTERLY PRODUCTION, IMPORTS AND SALES OF GYPSUM AND GYPSUM PRODUCTS IN THE UNITED STATES IN 1931, AS REPORTED BY OPERATORS

	First Quarter	Second Quarter	Third Quarter
Number of operators reporting	33	35	34
Crude gypsum mined (*short tons*)	545,018	851,082	640,068
Crude gypsum imported (as reported by importers) (*short tons*)	[1]	156,448	303,784
Crude gypsum sold (domestic and imported) (*short tons*)	126,543	262,841	234,938
Calcined gypsum produced from domestic and imported rock (*short tons*)	444,116	578,621	493,552
Calcined gypsum products sold from domestic and imported rock:			
For pottery, terra cotta, plate glass, mixing plants, etc. (*short tons*)	54,921	51,993	44,010
Keenes cement (*short tons*)	7,894	7,658	6,990
Neat, wood fiber, sanded, gaging, finished plasters, etc. (*short tons*)	302,237	410,942	373,808
Wall board (*square feet*)	88,569,846	105,129,361	72,122,523
Plaster board and lath (*square feet*)	53,873,521	65,925,953	56,525,903
Partition tile (*square feet*)	6,052,441	7,016,019	5,315,636
Roof tile (*square feet*)	[1]	[1]	[1]
Other tile (*square feet*)	[1]	[1]	[1]
Other calcined gypsum sold (*short tons*)	3,427	3,376	3,313

[1] Less than three operators reporting.

Operators whose figures are included in the statement for the third quarter in the table include: American Gypsum Co.; Arizona Gypsum Plaster Co.; Atlanta Gypsum Products Co.; Atlas Gypsum Products Corp.; Beaver Products Co. of Virginia, Inc.; Best Brothers Keene's Cement Co.; Blue Diamond Corp.; Cardiff Gypsum Plaster Co.; Certain-teed Products Corp.; Colorado Portland Cement Co.; Connecticut Adamant Plaster Co.; Ebsary Gypsum Co.; Grand Rapids Plaster Co.; Gulf Gypsum Co.; Jumbo Plaster & Cement Co.; Hawkeye Gypsum Products Co.; Lycoming Calcining Co.; Michigan Gypsum Co.; National Gypsum Co.; Newark Plaster Co.; Oakfield Gypsum Products Corp.; Pacific Portland Cement Co.; Paoli Gypsum Mine, A. P. Shepard; Phoenix Gypsum Co., Inc.; Chas. W. Priddy & Co., Inc.; Regan Brothers; Rutland Fire Clay Co.; Standard Gypsum Co.; Texas Cement Plaster Co.; Three Forks Portland Cement Co.; Universal Gypsum & Lime Co.; United States Gypsum Co.; and Victor Plaster, Inc.

MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is selected without significance as to current events or the position of the individual in the industry.

Falk Photo

R. A. BECHTOLD

Superintendent

Pennsylvania-Dixie Cement Corp.

Des Moines, Ia.

Coming Events

Jan. 9-15, 1932. Detroit, Mich. Annual Convention and show, American Road Builders' Assn. Chas. M. Upham, engineer-director, National Press Bldg., Washington, D. C.

Jan. 14, 1932. St. Louis, Mo. Monthly meeting, St. Louis Quarrymen's Assn., Forest Park Hotel. E. J. McMahon, exec. sec., 4063 Forest Park Blvd., St. Louis, Mo.

Jan. 19-22, 1932. Pittsburgh, Pa. Annual Convention, National Crushed Stone Assn., Wm. Penn Hotel. J. R. Boyd, secretary, Merchandise Bldg., Washington, D. C.

Jan. 25-26, 1932. Pittsburgh, Pa. Annual convention, National Ready-Mixed Concrete Assn., Wm. Penn Hotel. V. P. Ahearn, executive secretary, Munsey Bldg., Washington, D. C.

Jan. 27-29, 1932. Pittsburgh, Pa. Annual convention, National Sand & Gravel Assn., Wm. Penn Hotel, V. P. Ahearn, executive secretary, Munsey Bldg., Washington, D. C.

Feb. 3-4, 1932. Washington, D. C. Annual meeting, Sand-Lime Brick Assn. Ellen Knight, sec., 321 N. Hamilton St., Saginaw, Mich.

Feb. 23-26, 1932. Wichita, Kan. Seventh Annual Southwest Road Show and School.

Feb. 23-26, 1932. Washington, D. C. Annual convention, American Concrete Institute, Wardman Park Hotel. Harvey Whipple, sec., 2970 West Grand Blvd., Detroit, Mich.

March 1-4, 1932. Washington, D. C. Twenty-eighth annual convention, American Concrete Institute. Harvey Whipple, secretary-treasurer, 2970 West Grand Blvd., Detroit, Mich.

Pumpings from the Old Pit

Excerpts from the old files of PIT AND QUARRY *reveal many interesting sidelights on the activities of the pits, quarries and plants of former days. These are printed in this column each issue.*

Fifteen Years Ago

A NEW sand-and-gravel plant was placed in operation by J. W. Thompson at Anchorage, Miss. Four dredges were used to recover the material which was brought to the plant by barges and unloaded by a floating stiff-leg derrick. The plant, said to have been the largest and most modern in the South, had a capacity of 2,000 cu. yd. per day. The operation was designed and erected under the supervision of Greneke & Fay, St. Louis, Mo.

* * *

An article by Ernest McCullough urged that specification writers discard the use of the word "sharp" in sand specifications as being meaningless.

* * *

Ten Years Ago

ONE of the early applications of the Swintek suction-screen nozzle ladder for dredging sand and gravel was described in an article concerning the remodeled plant of the Southern Illinois Sand & Gravel Co. at Metropolis, Ill. The ladder, invented by Martin Swintek, was at that time being manufactured by the American Traveling Suction Screen Nozzle Co., Eddyville, Ia., and sold by the W. H. K. Bennett Co., Chicago.

* * *

The California Gypsum Corp. of Los Angeles was erecting a plant at Coyote Wells, Cal. Officers of the company were Charles F. Gutbridge, president; C. F. Fuller, vice-president; and John Scheufler, secretary-treasurer.

* * *

The Uvalde Rock Asphalt Co. of San Antonio, Tex., was rebuilding a portion of its plant following damage caused by fire.

* * *

The Cement Medical Assn. was formed at a meeting in the Allen Hotel, Allentown, Pa. Members were physicians from Northampton, Coplay, Cementon and Egypt who served the various cement companies in operation in the Lehigh Valley producing area. Dr. H. Y. Horn of Coplay was elected president.

* * *

The Champion Gravel Co. was organized at Iron Mountain, Mich. P. B. Spear of Marquette, Mich., was president. The company took over an operating plant at Champion and planned the erection of another at Pound, Wis.

* * *

Five Years Ago

THE National Lime Assn. moved into its new and larger quarters at 927 Fifteenth St., Washington, D. C.

* * *

The first lime kiln was fired at the new plant of the New England Portland Cement & Lime Co. at Thomaston, Me. The plant, built and erected under the supervision of Alfred S. Black, its president, was shortly afterward sold to the Lawrence Portland Cement Co.

At the annual meeting of the Wisconsin Mineral Aggregate Assn. held at Milwaukee, the following officers were elected to serve during 1927: George G. Brew, Waukesha Washed Sand Co., president; M. W. Deutsche, North Shore Gravel Co., vice-president; E. E. Gillen, Waukesha Lime & Stone Co., secretary and treasurer.

* * *

New incorporations included Victor Sand Co., Camden, N. J.; Fayette Rock Co., Lexington, Ky.; Blue Diamond Co. of Washington; James Sand & Gravel Co., Johnsonville, Tenn.; and Red River Crushed Stone Co., Dover, Del.

New Corporations

WORTH MILLING CO., INC., Middletown, Conn. $150,000, 1500 sh. @$100. Robert A. Van Voorhis, Belleville, N. Y.; R. H. Toothe, Brooklyn, N. Y.; A. M. Docken, Woodside, N. Y. To produce and deal in sand, gravel, etc.

GLENNS VALLEY GRAVEL CO., INC., Greenwood, Ind. 100 sh. @$100. John B. Webb, Charles Shannon, Leonard A. Hohlt.

KINGSLAND GRANITE CORP., Llano, Tex. $35,000. W. H. Johnson.

M. M. THOMAS FLINT ROCK CORP., Ocala, Fla. 100 sh. @$100. M. M. Thomas, C. C. Williams and C. C. Lory, directors.

ATLAS QUARRIES, INC., Miami, Fla. J. M. Deer, 833 N. W. 13th St., and others.

SEQUOYAH MARBLE CO., Marble City, Okla. Organized to take over marble quarry. W. K. Palmer, Kansas City, Mo., consulting engineer and managing director.

CHICAGO WAYLITE AGGREGATE CO., Danville, Ill. $30,000 pref. and 600 sh. n.p.v. H. A. Adams, W. M. Acton and D. S. Baldwin.

Buys Bucket and Trailer Lines from Williams Co.

The Wellman Engineering Co. of Cleveland, O., has purchased the clamshell bucket and heavy-duty trailer business of the G. H. Williams Co. of Erie, Pa. Engineering, manufacture and sale of this equipment will be immediately transferred to the Wellman plant in Cleveland.

W. C. Swalley, secretary and general manager; A. J. Lichtinger, assistant manager; C. F. Weiblen, sales manager; and P. T. Robin, chief engineer of the G. H. Williams Co., will be associated with The Wellman Engineering Co. at Cleveland in the manufacture and sale of these lines. They will continue to be marketed under the trade names "Williams bucket" and "Williams trailer," the Williams bucket making an important addition to the type heretofore built by the Wellman company.

Personal Mention

W. H. Allswede, well-known aggregates producer in the vicinity of Grand Rapids, Mich., has purchased the plant of the Midland Gravel Co. situated 4 mi. southeast of Remus, Mich. Mr. Allswede will not operate the newly acquired plant, however, planning instead to remove the machinery to another plant in which he is interested at Grand Rapids. The Midland operation has been idle for the past four years.

William H. Waite has been appointed sales manager of the Browning Crane & Shovel Co. of Cleveland, O., succeeding R. G. Miller, Jr., who recently resigned. Mr. Waite was formerly in the New York sales office of the company.

J. N. Barnes, C. M. Burdette and **F. G. Nunneley** have been appointed assistant sales managers in charge of district representatives and a group of dealers for Caterpillar Tractor Co, Peoria, Ill. Mr. Barnes was district representative for the territory out of Macon, Ga., and has a sales history of 18 years with southern manufacturers. Mr. Burdette was formerly with Hyatt Roller Bearing Co. and Sharples Cream Separator Co. in important sales-executive positions. Mr. Nunneley has a Canadian sales background with Ford, Caterpillar and Cockshutt Plow.

John Anderson, assistant to **J. G. Barry,** vice-president, has been appointed secretary of the sales committee of the General Electric Co., it was announced by Mr. Barry. Mr. Anderson succeeds **E. G. Waters,** who is retiring at his own request on the completion of more than 42 years continuous service, the past 25 as secretary of the sales committee.

Melvin C. Molstad has resigned from the ammonia division of E. I. duPont de Nemours & Co., at Charleston, W. Va., to become assistant professor of chemical engineering at Yale University.

Dr. Edward R. Weidlein, director, Mellon Institute of Industrial Research Pittsburgh, Pa., has announced that the Lukens Steel Co. of Coatesville, Pa., has established an industrial fellowship for the scientific investigation of processes employed in the manufacture of steel plates. **Erle G. Hill,** who received his professional education at the University of California, has been appointed to the incumbency of this Fellowship. He is a specialist in iron and steel technology sor of metallurgy in the School of who was previously associate profes-Mines of the University of Pittsburgh.

R. H. Morse.

Robert H. Morse, formerly vice chairman of the board of directors, Fairbanks, Morse & Co., has been elected president and general manager to succeed W. S. Hovey, who resigned, December 1. Mr. Morse was born in Chicago, Ill., December 6, 1878. In 1895 he entered the employ of Fairbanks, Morse & Co., the firm founded by his father, C. H. Morse. In the thirty-six years, he has been employed in various positions as salesman, department manager, branch-house manager, sales manager, president of the manufacturing division, vice-president in charge of purchases, first vice-president, vice-chairman of the board and now president and general manager.

Robert Allgeier has allied himself with two other business men in Spokane in the marketing of magnesite products, the stock to come from the plant of the Northwest Magnesite Co. at Chewelah, Wash.

Lew Hansen, manager of the Silica Products Co. plant at Clayspur, near Osage, Wyo., has estimated the loss in the fire at the plant in the neighborhood of $50,000. Origin of the fire remains a mystery. The warehouse with 2,650 tons of bentonite were destroyed. The plant was one of the most extensively equipped in the United States, special machinery being required for the production of bentonite and aqua-jel.

Fred Schmidtke has opened a small crushed-stone plant on the outskirts of the town of Washington, Wis.

Obituary

Earl R. Cartwright, 52, treasurer of the Midwest Rock Products Co., died December 1 at his home in Portland, Ind. Mr. Cartwright had been ill about three months. In addition to being quite well known in the Middle West crushed-stone circles, Mr. Cartwright was a nationally-known baritone singer. He had studied music in New York and Berlin and toured the United States for several years with the Boston Festival Orchestra. He is survived by the widow.

Harry Siders, 34, **John Seely,** 33, and **Hanley Johnson,** 38, were killed and a number of other workmen were injured in a fall of rock in a tunnel of the new shale mine of the Western Brick Co. near Danville, Ill., on November 20. Nine men were in the tunnel when the fall occurred, including Supt. John Bernard, who escaped injury.

Harry T. Wickes, one of the founders of the Wickes Boiler Co. and of the United States Graphite Co., Saginaw, Mich., died in Los Angeles recently following an operation. It was largely through the efforts of Mr. Wickes and his brother, William J. Wickes, that Saginaw was transformed from a lumber town into an industrial center. He took an active part in the management of the Wickes Boiler Co. until 1922, when ill health forced him to retire. He was 71 years old.

Frederick L. Naylor, president of the Naylor Pipe Co. of Chicago, died at his home there early this month. He was a native of Iowa and was 60 years old at the time of his death. The widow, two sons and a daughter survive.

Julius Wise, aged 63, president of the Lima Stone Co. of Lima, O., died at his home in that city on December 8. Mr. Wise had apparently been enjoying good health and was stricken while at work in the office of his company.

William Schnaufer, Jr., secretary of the Calaveras Cement Co. of California and an official of the Bishop Oil Co., died at San Francisco on December 6, after a short illness. Formerly connected with the International Nickel Co. at New York, Mr. Schnaufer came to California six years ago.

Charles M. Helmer, president of the Hall Fire Brick Co., Inc., Buffalo, died at his home in that city recently, after a long illness. He had been identified with the brick-manufacturing industry for nearly half a century.

Latest Portland-Cement Statistics

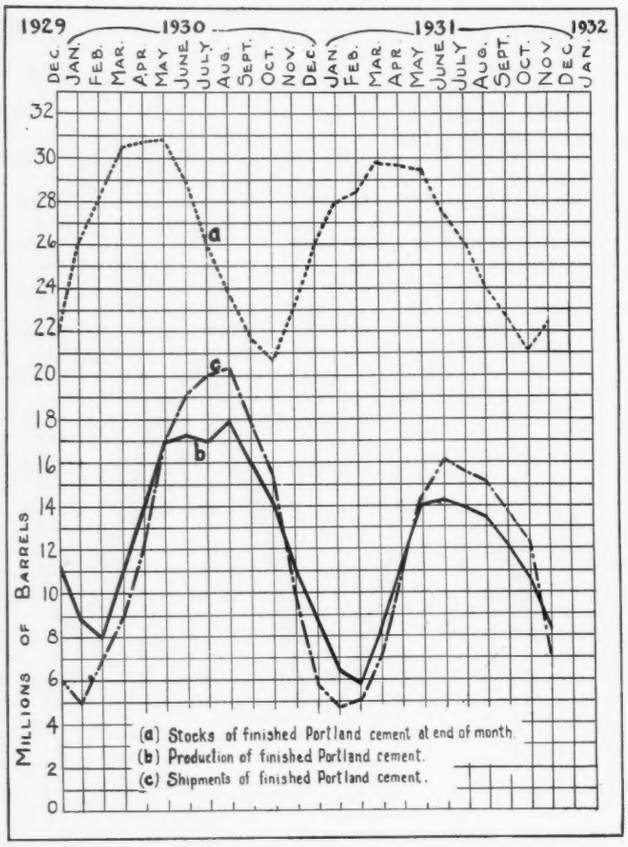

1929
1930
1931
1932
DEC. JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN.
MILLIONS OF BARRELS
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32
a
b
c
(a) Stocks of finished Portland cement at end of month.
(b) Production of finished Portland cement.
(c) Shipments of finished Portland cement.

Chart showing production, shipments and stocks on hand, by months, from December, 1929, to November, 1931.

THE Portland-cement industry in November, 1931, produced 8,161,000 bbl., shipped 7,156,000 bbl. from the mills, and had in stock at the end of the month 22,223,000 bbl. Production of Portland-cement in November, 1931, showed a decrease of 26.5 per cent. and shipments a decrease of 18.5 per cent., as compared with November, 1930. Portland-cement stocks at the mills were 3.6 per cent. lower than a year ago.

In the statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 165 plants both at the close of November, 1931, and of November, 1930. The estimates include increased capacity due to extensions and improvements during the period.

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES AND BY DISTRICTS, IN OCTOBER, 1931

Imported from—	District into which imported	Barrels	Value
Canada	Michigan	8	$ 24
Denmark	Porto Rico	14,633	12,438
France	New York	147	526
Japan	Hawaii	1,125	1,176
United Kingdom	New York	23,729	28,216
		39,642	42,380

DISTRIBUTION OF CEMENT

Shipped to—	September		October	
	1930	1931	1930	1931
Alabama	68,936	60,846	88,358	50,940
Alaska	1,362	835	697	808
Arizona	39,785	33,835	33,524	27,780
Arkansas	150,714	49,943	144,307	40,635
California	836,501	523,744	931,721	580,258
Colorado	82,050	87,979	78,683	86,048
Connecticut	195,962	159,798	153,822	162,540
Delaware	26,704	43,222	20,017	27,187
District of Columbia	137,507	125,178	154,670	122,498
Florida	76,333	51,414	89,354	51,252
Georgia	163,464	164,838	174,340	162,410
Hawaii	16,778	18,544	23,850	21,468
Idaho	46,308	19,173	34,385	15,481
Illinois	1,704,696	975,734	1,586,016	856,580
Indiana	497,163	466,096	321,285	313,599
Iowa	781,608	305,343	317,288	209,676
Kansas	250,548	173,915	226,472	166,235
Kentucky	241,402	173,093	223,805	149,282
Louisiana	163,544	555,155	172,194	485,188
Maine	148,381	59,275	87,454	46,894
Maryland	285,312	206,115	257,617	291,938
Massachusetts	331,061	392,466	376,533	344,866
Michigan	1,018,648	620,928	867,458	461,985
Minnesota	374,833	432,521	237,592	242,908
Mississippi	51,680	33,326	39,377	23,656
Missouri	710,759	424,958	713,573	481,965
Montana	44,217	30,420	27,189	21,927
Nebraska	241,572	264,988	174,005	194,514
Nevada	16,111	12,735	18,751	18,440
New Hampshire	84,449	59,641	48,117	51,874
New Jersey	610,200	599,005	664,381	645,068
New Mexico	28,870	21,342	27,047	25,380
New York	2,515,171	2,316,622	2,063,858	2,096,119
North Carolina	102,658	61,534	101,403	59,103
North Dakota	38,358	19,533	24,513	17,110
Ohio	1,103,327	805,284	1,011,292	749,570
Oklahoma	348,023	140,858	270,430	174,121
Oregon	112,133	88,543	130,953	91,480
Pennsylvania	1,557,564	857,987	1,351,511	781,503
Porto Rico	10,250	4,037	5,000	4,515
Rhode Island	100,664	63,719	76,031	54,139
South Carolina	245,776	186,108	273,208	243,408
South Dakota	86,654	86,660	44,410	29,736
Tennessee	294,910	99,884	271,922	111,024
Texas	573,392	601,256	438,457	542,920
Utah	39,116	26,160	38,549	22,669
Vermont	66,810	49,250	53,087	32,942
Virginia	174,179	151,914	155,410	122,618
Washington	328,595	188,660	324,276	157,064
West Virginia	196,307	161,154	139,483	142,876
Wisconsin	700,327	474,841	414,797	389,339
Wyoming	20,224	12,405	20,691	10,638
Unspecified	4,888	104,386	40,039	121,253
	18,046,784	13,647,200	15,563,202	12,335,427
Foreign countries	36,216	23,800	35,798	24,573
Total shipped from cement plants	18,083,000	13,671,000	15,599,000	12,360,000

EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES IN OCTOBER, 1931

Exported to—	Barrels	Value
Canada	1,102	$ 5,621
Central America	2,567	6,929
Cuba	2,259	5,658
Other West Indies and Bermuda	1,484	2,936
Mexico	2,570	8,619
South America	12,454	28,068
Other countries	2,095	10,693
	24,531	68,524

RELATION OF PRODUCTION TO CAPACITY

	November		October 1931 (per cent.)	September 1931 (per cent.)	August 1931 (per cent.)
	1930 (per cent.)	1931 (per cent.)			
The month	51.7	37.2	47.4	55.3	60.2
The 12 months ended	62.6	44.4	48.6	50.2	52.0

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1930 AND 1931 (*thousands of barrels*)

Month	Production		Shipments		Stocks at End of Month	
	1930	1931	1930	1931	1930	1931
January	8,498	6,595	4,955	4,692	27,081	27,759
February	8,162	5,920	7,012	5,074	28,249	28,612
March	11,225	8,245	8,825	7,192	30,648	29,676
April	13,521	11,245	13,340	11,184	30,867	29 715
May	17,249	14,010	17,224	14,200	30,891	29,554
June	17,239	14,118	18,781	16,077	29,364	27,602
July	17,078	13 899	20,153	15 545	26,289	25,931
August	17,821	13,549	20,299	15,172	23,824	24,313
September	16,124	12,092	18,083	13,671	21,889	22,736
October	14,410	10,762	15,599	12 360	20,697	21.218
November	11,098	8,161	8,784	7,156	23,056	22,223
December	8,480	.....	5,688	.....	25,838	.....
Totals	160,905	.....	158,741	.....	.....	.....

PRODUCTION AND STOCKS OF CLINKER, BY DISTRICTS, in NOVEMBER 1930 and 1931 (*thousands of barrels*)

District	Production		Stocks at end of Month	
	1930	1931	1930	1931
Eastern Pa., N. J., and Md	2,235	1,922	917	601
New York and Maine	1,030	750	547	276
Ohio, Western Pa., and W. Va	1,263	747	834	705
Michigan	917	338	793	524
Wis., Ill., Ind., and Ky	1,337	1,047	755	464
Va., Tenn., Ala., Ga., Fla., and La	972	746	964	611
Eastern Mo., Ia., Minn., and S. Dak	1,092	798	475	462
W. Mo., Neb., Kan., Okla., and Ark	885	578	447	495
Texas	498	479	331	289
Colo., Mont., Utah, Wyo., and Idaho	29	58	305	88
California	1,002	609	1,081	1,292
Oreg. and Wash	379	187	309	405
Totals	11,639	8,259	7,758	6.212

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN NOVEMBER, 1930 AND 1931, AND STOCKS IN OCTOBER 1931 (*thousands of barrels*)

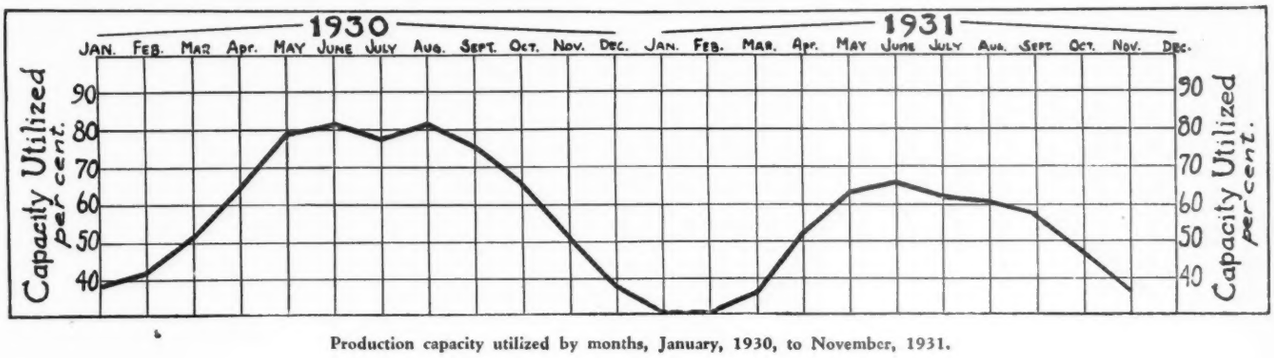
District	November						Stocks at End of October 1931
	Production		Shipments		Stocks at End of Month		
	1930	1931	1930	1931	1930	1931	
Eastern Pa., N. J., and Md	2,390	2,046	2,124	2,064	4,521	4,649	4,668
New York and Maine	924	686	617	661	1,395	1,185	1,159
Ohio, Western Pa., and W. Va	1,045	769	830	581	3,285	3,310	3,122
Michigan	943	345	538	267	2,722	2,011	1,893
Wis., Ill., Ind., and Ky	1,233	894	857	761	2,922	2,485	2,352
Va., Tenn., Ala., Ga., Fla., and La	877	733	807	763	1,767	1,654	1,684
Eastern Mo., Ia., Minn., and S. Dak	1,131	827	739	474	1,934	2,725	2,372
W. Mo., Neb., Kan., Okla., and Ark	743	566	632	475	1,763	1,311	1,219
Texas	502	459	453	378	769	639	558
Colo., Mont., Utah, Wyo., and Idaho	40	97	118	85	335	485	474
California	817	555	728	527	1,100	1,114	1,086
Oreg. and Wash	413	144	341	120	543	655	631
Totals	11,098	8,161	8,784	7,156	23,056	22,223	21,218

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1930 AND 1931

Month	Exports				Imports			
	1930		1931		1930		1931	
	Barrels	Value	Barrels	Value	Barrels	Value	Barrels	Value
January	82,387	$293,135	41,199	$115,678	201,609	$207,461	97,057	$132,937
February	64,267	217,798	25 703	88,989	114,455	119,717	22,370	26,250
March	117,563	357,896	54,599	144 579	43,622	59,981	70,532	80,686
April	57,419	200,217	40,478	116,564	140,871	178,226	54,717	61,728
May	57,423	198,170	48,028	140,953	94,696	111,998	20,061	22.794
June	82,077	223,639	43,619	107,977	55,356	74,370	32,080	42 955
July	47,082	166,577	29.494	97,995	12,404	20,973	17,445	22,349
August	49,031	167,579	39 517	106 643	35,323	39,029	9,760	13 404
September	46,664	153,384	27,543	81 399	51,096	59,721	33.575	33.520
October	62,690	190,305	24 531	68,524	75,284	84,364	39,642	43,380
November	50,495	151,555	.....	.....	109,124	125,448	.....	.....
December	38,680	131,260	.....	.....	44,157	59,641	.....	.....
Totals	755,778	$2,454,515	.....	.....	977,997	$1,140,929	.....	.....

PRODUCTION AND STOCKS OF CLINKER BY MONTHS, IN 1930 AND 1931 (*thousands of barrels*)

Month	Production		Stocks End of Month	
	1930	1931	1930	1931
January	10,504	8,129	9,646	10,384
February	10,008	7,473	11,572	11,946
March	13,045	9,586	13,503	13,318
April	15,025	11,540	15,164	13,854
May	16,607	13,159	14,668	13 087
June	15,895	12,679	13,452	11,837
July	15,069	12,246	11,684	10 209
August	15,244	11 664	9,275	8,468
September	14,577	10,414	7,783	6 918
October	13,895	9,825	7,266	6,021
November	11,639	8 259	7,758	6 212
December	9,484	.....	8,809	.....



Production capacity utilized by months, January, 1930, to November, 1931.

Recent Patents

AMERICAN

Cement and Concrete

Process for the manufacture of cement. Oscar Nickel, Mulheim-Ruhr, and Reinhold Markwitz, Duisburg, Germany. No. 1,834,799.

Method of preparing concrete. Martin A. Morrissey, Roslindale, Mass., and Almer F. Moore, Brighton, Mass. No. 1,832,875.

Crushing and Grinding

Pulverizer and separator. George H. Fraser, Brooklyn, N. Y. No. 1,834,094.

Pulverizing mill. Hugh R. Carr, Chicago, Ill. No. 1,833,560.

Excavating and Loading

Tripping mechanism for hoisting buckets. Fred Schmitt, University City, Mo. No. 1,833,915.

Replaceable excavator tooth. Glenn E. Edmonds, Columbus, O., assignor to Bonney-Floyd Co., same place. No. 1,834,391.

Propulsion means for power shovels and the like. William W. Sloane, Chicago, Ill., assignor to Goodman Mfg. Co., same place. No. 1,834,538.

Loading machine. Wade H. Wineman, Michigan City, Ind., assignor to Sullivan Machinery Co., Claremont, N. H. No. 1,834,587.

Bucket-hoist control. Benjamin W. Jones, Schenectady, N. Y., assignor to General Electric Co. No. 1,834,785.

Power hoe. Holger L. Mitchell, Milwaukee, Wis., assignor to Harnischfeger Corp., same place. No. 1,832,911.

Material-handling apparatus. Jay M. Amsden, Ashtabula, O., assignor to M. A. Hanna Co., Cleveland, O. No. 1,833,102.

Clam-shell bucket. Charles A. Carney, Erie, Pa., assignor to G. H. Williams Co., same place. No. 1,833,389.

Excavating shovel. John W. Page, Chicago, Ill. No. 1,833,587.

Excavating tooth. William H. Brune, Chicago Heights, Ill., assignor to American Manganese Steel Co., Chicago, Ill. No. 1,834,514.

Paving Materials

Road composition. Samuel S. Sadtler, Springfield Township, and Eugene F. Cayo, Philadelphia, Pa., assignors to Amiesite Asphalt Co., Philadelphia. No. 1,834,552.

Apparatus for weighing the ingredients of paving materials prior to the mixing thereof. John W. Davitt, Jersey City, N. J. No. 1,833,775.

FOREIGN

Blasting

Smokeless powder. Canadian Industries, Ltd., Montreal, Que. Canadian 317,629.

Blasting cartridge for blasting rock. Siemens & Halske Akt.-Ges., Berlin-Siemensstadt. German 539,166.

Cement and Concrete

Mortars, concretes and the like. Chemische, Fabrik Grünau Landshoff & Meyer Akt.-Ges. British 361,094.

Process for producing concrete with a minimum of pores. Modern Concrete Development Co., Ltd., London, England. German 539,673.

Cement paint. Canadian Gypsum Co., Ltd., Toronto, Ont. Canadian 317,827.

Crushing and Grinding

Grinding mills. Babcock & Wilcox, Ltd. (Babcock & Wilcox Co.). British 359,979.

Pulverizers. Erie City Iron Works. British 360,452.

Eccentric or draw rods for stone crushers. F. Krupp Grusonwerk Akt.-Ges. British 360,747.

Pulverizer. The Grindle Fuel Equipment Co., Harvey, Ill. Canadian 317,659.

Grinding-mill ball. Fuller-Lehigh Co., Fullerton, Pa. Canadian 317,855.

Drilling

Pneumatic percussive tools. Demag Akt.-Ges. British 360,538.

Drifts for ejecting drills and the like from sockets. C. T. Skipper and Roberts, Black & Co., Ltd. British 360,598.

Manufacture of hollow drill-steel and hollow metal goods. Fagersta Bruks Aktiebolag. British 361,163.

Well-drilling apparatus. Wilhelm Pattberg, Essen. German 539,632.

Device for determining the variation of drill holes from the vertical. Harry Joseph Morgan, Walnut Park, Calif. German 539,633.

Drying

Feeding apparatus for rotary drier. Ernst Scheidling and Curt Feind, Freiberg, Saxony. German 539,246.

Excavating

Suction dredges. J. Reid. British 360,359.

Screening devices for the test stream of hydraulic dredges. W. H. Miller. British 360,629.

Gypsum

Plaster ovens of the type in which the gypsum is in direct contact with the hot gases employed for baking. A. Bourdet. British 359,900.

Kilns

Rotary kilns for burning cement, lime and similar materials. G. & T. Earle, Ltd., and F. W. Davis. British 360,467.

Process for burning cement in rotary kilns with regulation of temperature and composition of gases. Dipl.-Ing. Jakob Koch, Heidelberg. German 539,693.

Tunnel kiln. Frank M. Hartford, Columbus, Ohio, and Samuel M. Kier, Salina, Pa. Canadian 317,511.

Kiln. Bessemer Cement Corp., Youngstown, Ohio, assignee of Haavard Kronstad, Bessemer, Pa. Canadian 317,819.

Material-Handling

Conveyors particularly for use in underground workings. British Jeffrey-Diamond, Ltd., and H. Tinsley. British 360,105.

Endless-belt conveyors. F. Scott and F. Bainbridge. British 360,134.

Door-operating mechanism for hopper cars. Gloucester Railway Carriage & Wagon Co., Ltd., and A. G. Watkins. British 360,217.

Cranes. Sir W. Arrol & Co., Ltd., and R. G. Shepherd. British 350,218.

Cranes. J. F. Glazebrook. British 360,337.

Manufacture of rubbered-fabric endless-transmission belts, and the apparatus therefor. Dunlop Rubber Co., Ltd., and H. Bartle. British 361,060.

Mining

Mine-roof and other supports. W. J. Leonard, W. Britton and A. M. Morison. British 359,949.

Mining-machine bit and bit-holder. F. B. Dehn (Cincinnati Mine Machinery Co.). British 361,111.

Loading machine for underground mining. Richard Gerlicher, Fürth a. Berg. German 539,696.

Mixing

Concrete mixers and agitators. C. F. Ball. British 360,149.

Hand mixer for mortar. Franz Wenzlokat, Sundern, Westfalia. German 539,674.

Mixing apparatus for mortar, concrete or the like. Usines de Thisselt-lez-Willebroeck, pour la Fabrication de Carreaux en Ciment et de Pièces en Beton, Soc. Anon., Thisselt, Belgium. German 539,752.

Mixer for slurry-like fluids. Arno Andreas, Munster, Westfalia. German 539,678.

Mixing machine. George J. Hicks, Saginaw, Mich. Canadian 317,772.

Sacking

Process and apparatus for weighing and filling granular or pulverulent materials into receptacles, particularly bags. A. Andreas. British 360,580.

Method of and apparatus for the making of waterproof bags. Norsk Hydro-Elektrisk Kvaelstof—Aktieselskab. British 361,256.

Filling device. Arno Andreas, Münster i. W. German 539,446.

Bag-filling machine. Arno Andreas, Muenster, Prussia, Germany. Canadian 317,524.

Multi-wall paper bag. Thomas Earl Coty, Watertown, N. Y. Canadian 317,540.

(Continued on page 80)

PIT AND QUARRY *will furnish, at its actual cost, a copy of any patent cited here. A charge of ten cents per copy is made by the U. S. Patent Office, Washington, D. C., and readers may procure a copy directly by addressing the Commissioner of Patents, with payment for copies requested. Postage stamps are not accepted by the Patent Office. We will endeavor to obtain copies of foreign patents for our readers but we cannot give assurance in every case for the reason that copies of such patents are not printed for distribution as liberally as are the American copies, nor is there a fixed charge per copy.*

Traffic News and Comment

Recent I. C. C. Decisions

Asphalt Aggregate.—Rates on asphalt aggregate (sandstone with asphalt content, coated with free asphalt), from Big Clifty, Ky., to Dunbar, Matoaka and Spring Hill, W. Va., have been found unreasonable to the extent they exceeded $2.80 a net ton to Spring Hill, $3.40 to Matoaka and $2.90 to Dunbar, and reparation has been awarded. I. C. C. Docket No. 24,009, O. A. Smith Agency, Inc., v. I. C. et al.

Cement Compound.—The rate on cement compound from Berkeley, W. Va., to Chicago, Ill., has been found unreasonable to the extent it exceeded or may exceed 25 per cent. of the contemporaneous first-class rate, c. l. min. wt. 50,000 lb. The new rate is to be made effective not later than March 10. I. C. C. Docket No. 23,139, North American Cement Corp., v. B. & O. et al.

Gypsum Rock.—The Commission has found that the rate on gypsum rock, c. l. min. wt. 90 per cent. of the marked capacity of the car but not less than 80,000 lb., from New Brighton, N. Y., to York, Pa., was unreasonable over the direct route to the extent that it exceeded or may exceed $1.80 a net ton, but not unreasonable over other routes, and has awarded reparation on basis of these findings. The new rate is to be established not later than Feb. 29. I. C. C. Docket No. 23,398, Medusa Portland Cement Co., v. Pennsylvania et al.

Plaster and Plasterboard.—In a report covering two suspension proceedings and a formal complaint the Commission has found justified certain schedules that were issued to clarify tariffs and condemned others which resulted in increased rates.

The Commission was asked to determine the applicable rate on several movements where uncertainties were created by the rule in the class tariffs, that combinations would apply where they were lower than the through class rates, and by the rule in Kelly's Tariff No. 228 for making combination rates, and a rule for making plasterboard rates by adding 3½ c. to the plaster rates, in the complaint case. They found that the rate from Acme, Tex., to Andalusia, Ala., was 40 c. and not 37½ c. as claimed by shippers. The rate from Acme to Athens, Ala., was 39 c. and not 33, as claimed by shippers, nor 45, as claimed by carriers. The rate from Acme to Headland, Ala., was 36 c. This affirmed the finding in 151 I. C. C. 385, and added the further opinion that no minimum weight should be observed in connection with a differential when the differential was added to combinations, untreated by the use of the combination rule, when the factors were subject to different minima. The rate from Acme to Avera, Ga., was found to be 46 c. The rate from Acme to Barboursville, Ky., was 53 c., as claimed by the carriers, and not 48, as claimed by shippers; to Flemingsburg, Ky., 50½ c., and not 56½, as claimed by the carriers, nor 45½, as claimed by the shippers; to Garrett, Ky., 52½ c., and not 50, as claimed by shippers; to Olive Hill, Ky., 49 c., and not 44, as claimed by shippers. From Akron, N. Y., to Washington, D. C., the rate was found to be 40½ c., made by using a basing rate of 20 c. from Akron to Richmond, Va.

As the entire structure of plasterboard rates in the southeast is under consideration in I. and S. Docket No. 3,615, this decision is without prejudice to any conclusion that might be reached in that case.

The National Gypsum Co., of Buffalo and Chicago intervened in behalf of the complainant. A dissenting opinion written by Commissioner Lewis was joined in by Commissioners Myer, Tate and Mahaffie. I. and S. Docket No. 3,446, plasterboard, between points in southern territory; I. and S. Docket No. 3,419, plasterboard between points in official classification territory; and Docket No. 23,155, Certainteed Products Corp., v. A. & R. et al.

Examiners' Reports

Crushed Stone.—Examiner W. J. Harris recommends that the Commission find that the rates on crushed stone, crushed-stone screenings, and chert, from Rocky Point, Va., to destinations in North and South Carolina were and are unreasonable to the extent they exceeded or may exceed rates for like distances prescribed in "Rates on Chert, Clay, Sand and Gravel," reported in 122 I. C. C. 133, 140 I. C. C. 85, 160 I. C. C. 309, and 172 I. C. C. 219, distances to be computed over the route the shipment travels, but in no instance is the rate so made to exceed by more than 20 c. a net ton the rate that would be produced by applying the scale prescribed in that case to the distances over the shortest route over which carload traffic can be moved without transfer of lading. He further proposes that an arbitrary of 25 c. a ton may be added to points on the Aberdeen and Rockfish, Atlantic and Yadkin, Norfolk Southern and the Wilmington, Brunswick and Southern for their sole benefit. The examiner suggests that the rates on stone dust be found unreasonable to the extent they exceeded or may exceed rates prescribed in Falling Springs Lime Co., v. C. & O., 172 I. C. C. 783, for application on ground limestone from Barber, Va., to points in southern territory and that an arbitrary of 25 c. a ton be allowed the roads listed above. Reparation is proposed. I. C. C. Docket No. 22,315, Liberty Lime & Stone Co., v. A. & R. et al.

Crushed Stone.—Examiner L. B. Dunn, proposes that the Commission find the rate on crushed stone from Westfield, Mass., to White Plains, N. Y., not unreasonable or unduly prejudicial and dismiss the complaint. I. C. C. Docket No. 24,618, John S. Lane and Son, Inc., v. N. Y. N. H. & H. et al.

New Complaints Filed

Lime.—At the request of northwestern Ohio shippers, the Commission has suspended from December 3, until July 3, schedules in Supplement 8 to Boyd's I. C. C. A-2,099. The suspended schedules propose to revise the rates on lime between points in Western Trunk Line territory to remove fourth section departures, and resulted in both increases and decreases, the increases amounting to as much as $1.00 per ton. I. & S. Docket No. 3,667.

Rate-Committee Dockets

New England Freight Assn.

Plaster and Plasterboard.—It is proposed to provide the same rates on plaster, plasterboard and related commodities, from Harlem River (Oak Point), N. Y., to destinations in Trunk Line territory including western termini of the trunk lines, that now apply from New York Harbor Lighterage points. Docket No. 23,897.

Trunk Line Assn.

Cement.—Carriers propose to increase the rate on cement, c. l. min. wt. 50,000 lb., from Swedeland and West Conshohocken, Pa., to West Rutland, Centre Rutland and Rutland, Vt., for D. & H. Co., delivery, from 17½ to 19½ c. per 100 lb. The proposed rate is comparable with the present rate for Rutland R. R. delivery. Docket No. 28,162.

Fluorspar.—Carriers propose to establish rates on fluorspar within Trunk Line territory and from points in Trunk Line territory on the basis of 75 per cent. of the 6th class rate. Docket No. M-1,919.

Gypsum.—Shippers propose reductions in the rates on ground or crushed gypsum, c. l. min. wt. 40,000 lb., from Newburgh, N. Y., to destinations in C. F. A. territory as shown in Agent Curlett's Tariff I. C. C. A-306, changing the rating on this commodity to group 3 rates on page 431 of above tariff instead of group 4 rates which now govern. The proposed rates are comparable with the rates now in effect on wall plaster. Docket No. 28,121.

Central Freight Assn.

Cement.—Carriers propose to reduce the rate on cement, c. l. min. wt. 50,000 lb., from Kosmosdale, Ky., to

Newmarket, Brown's Valley and Waveland, Ind., from 15 c. to 12 c. per 100 lb. Docket No. 29,912.

Cement.—A reduction in the rate on cement, c. l. min. wt. 50,000 lb., from Buffington, Ind., to West Jefferson, O., for Cincinnati and Lake Erie R. R. delivery, from 22½ c. to 15 c. per 100 lb., is proposed by shippers. Docket No. 29,913.

Illinois Freight Assn.

Agricultural Limestone.—Reduced rates on agricultural limestone from Cordova, Ill., to points on the C. R. I. & P., in Illinois have been proposed. Rates per net ton in Docket No. 6,367, to representative points are:

To	Present	Proposed
Colona, Ill.	$1.20	$0.93
Geneseo, Ill.	1.20	.98
Atkinson, Ill.	1.20	1.00
Sheffield, Ill.	1.20	1.04
DePue, Ill.	1.20	1.13
Crampton, Ill.	1.20	.92

Cement.—It is proposed to provide that shipments of cement may be stopped in transit at La Salle, Ill., from Utica, Ill., and that shipments from La Salle, Ill., may be stopped at Utica, Ill., to complete loading at the through rate from point of origin to final destination plus charge of $6.30 per car. Docket No. 6,308.

Dolomite.—Shippers propose a reduction in the rate on roasted or burnt dolomite[1], from Chicago, Ill., to Bettendorf, Ia., from $3.70 to $1.85 a net ton. Docket No. 4,231.

Lime.—Shippers propose rates based on two minimum weights on lime from Duluth, Minn., to Mobridge, S. D. They propose in addition to the present rate of 37 c., c. l. min. wt. 24,000 lb., a rate of 32½ c., c. l. min. wt. 30,000 lb. Docket No. 4,801-D.

Two minimum weights are proposed by shippers to apply on lime from Quincy and Marblehead, Ill., and Hannibal, Mo., to Elwin, Ill. In addition to the present rate of 10½ c., c. l. min. wt. 60,000 lb., they propose a rate of 8½ c., c. l. min. wt. 80,000 lb. Docket No. 377 Sub. 4-A.

Reductions in the rates on lime, c. l. min. wt. 30,000 lb., from Mosher and Ste. Genevieve, Mo., are proposed in Docket No. 377, Sub. 8-B, as follows:

To	Present	Proposed
Odin, Ill.	$0.13½	$0.11½
Sandoval, Ill.	.13½	.11½
Shattuc, Ill.	.14	.12
Ferrin, Ill.	.14	.12
Huey, Ill.	.14	.12
Carlyle, Ill.	.14	.12

It is proposed to reduce the rate on lime, c. l. min. wt. 80,000 lb., from Mosher and Ste. Genevieve, Mo., to Waterworks, Ill., from 12 c. to 10 c. per 100 lb. Docket No. 5,805-C.

Sand—It is proposed to reduce the rate on sand (all kinds)[1], from Ottawa, Ill., to Mt. Vernon, Ill., from $1.90 to $1.64 a net ton. Docket No. 6,259.

Sand and Gravel.—Reductions in the rates on sand and gravel[1], from Buckhart, Ill., to various points has been proposed. Representative rates in Docket No. 6,322 and Sub. 1, are:

To	Per Net Ton Present	Proposed
Beardstown, Ill.	$1.50	$0.76
Virginia, Ill.	1.40	.76
Gurney, Ill.	1.31	.76
Springfield, Ill.	1.01	.63
Beecher City, Ill.	1.70	.76
Altamont, Ill.	1.74	.88
Edgewood, Ill.	1.78	.90
E. Springfield, Ill.	1.01	.63
Keys, Ill.	.95	.63
Roby, Ill.	.72	.63
Blackland, Ill.	1.01	.63
Long Creek, Ill.	1.31	.76
Atwood, Ill.	1.48	.76
Newman, Ill.	1.70	.80
Hume, Ill.	1.73	.80

A reduction in the rate on common sand and gravel[1], from Cairo, Ill., to Johnson City, Ill., from 90 c. to 85 c. a net ton has been proposed. Docket No. 6,323.

It is proposed to reduce the rate on sand and gravel[1], from Muscatine, Ia., to Edwardsville, Ill., from $1.64 to $1.50 a net ton. Docket No. 6,335.

Reductions on Alton, Ill., sand and gravel rates[1], from $1.01 to 86 c. are proposed to apply to C. & I. M. stations: Beechley, Cimic, Pawnee, Sicily, Humphrey, Kincaid, Callaway and Taylorville, Ill. Docket No. 6,350.

Western Trunk Line Committee

Cement.—It is proposed to reduce the proportional rates on cement, c. l. min. wt. 50,000 lb., from Cairo, Ill., (applicable only on traffic originating at Birmingham, North Birmingham, Boyles and Phoenixville, Ala.) in Docket No. 6,247-B, as follows:

To	Rates per 100 Lb. Present	Proposed
St. Paul, Minn.	$0.33½	$0.23
Minneapolis, Minn.	.33½	.23
Northfield, Minn.	.33½	.23
Duluth, Minn.	.35	.23
Marquette, Mich.	.35	.23

Southern Freight Assn.

Crushed Stone, Sand, Gravel, Slag and Chert.—It is proposed to establish main line or trunk line basis of rates on crushed stone, sand, gravel, slag and chert to, from and between stations on the V. & C. S. R. R. Docket No. 56,205.

Feldspar.—Shippers propose that the rates on feldspar from Erwin, Tenn., and other producing points on the Clinchfield and Black Mountain railroads to Marion, Ind., be the same as currently in effect to Toledo, O. Docket No. 56,179.

It is proposed to publish the following rates on feldspar, c. l. min. wt. 50,000 lb., from producing points on the Sou. Ry., in western North Carolina, Bryson, Lake Toxaway, Marshall, Sylvia, etc., to Memphis, Tenn., Cairo, Ill., Evansville, Ind., Hickman, Ky., Metropolis (for beyond), Ill., Paducah, Ky., $3.94; Cincinnati (proper), O., Covington, Lexington and Louisville, Ky., New Albany (proper), Ind., and Newport, Ky., $3.44; Belleville and East St. Louis, Ill., and St. Louis, Mo., $5.49 per net ton. No change is contemplated in the present proportional rates to Cincinnati, O., Jeffersonville, and New Albany, Ind. Docket No. 56,276.

Magnesite.—Shippers propose a reduction in the rate on magnesite (crude, calcined and/or dead burnt), c. l. min. wt. 60,000 lb., from Joliet, Ill., to Memphis, Tenn., for 42 c. to 34 c. per 100 lb. Docket No. 56,269.

Southwestern Freight Bureau

Plaster.—Shippers desire that the present stopping in transit privilege on plasterboard as carried in Item No. 177 in S. W. L. Tariff No. 151, be extended to include plaster and to broaden the originating territory by amending condition No. 8 by eliminating reference to Oklahoma and Texas as origin territory. Docket No. 23,801.

[1] The c.l. min. wt. will be 90 per cent of the marked capacity of the car, except when the car is loaded to full cubical or visible capacity, actual weight will apply.

Recent Patents

(*Continued from page 78*)

Screening and Separating

Jigging mechanism. I. L. Bramwell and Birtley Co., Ltd. British 360,403.

Apparatus for removing dust from gases. N. L. Snow. British 360,366.

Process and apparatus for separating dust from the waste gases of furnaces or kilns. A. Andreas. British 360,547.

Machines for screening or grading road metal, gravel, sand, coal, and other classes of metal or minerals. J. G. Cameron. British 360,553.

Method of separating intermixed divided materials. Peale-Davis Co., Wilmington, Del. Canadian 317,931 and 317,932.

Unclassified

Method or process of and apparatus for manufacturing artificial stone, specially applicable to concrete tiles. R. Abraham, Ltd., and R. A. Abraham. British 359,928.

Institute on Materials Handling Is Organized

Every time a product of industry is moved unnecessarily in the process of production, the cost of manufacture goes up, but the value is not increased.

Realizing this, 75 manufacturers of materials handling equipment met at Cleveland recently and organized the Materials Handling Institute, a national organization intended to furnish the manufacturer with information on cost saving.

The institute will maintain a national headquarters in New York, furnishing information and making researches for the purpose of cutting production costs.

Manufacture of materials handling equipment today represents an investment of $200,000,000 and more capital is being attracted into this field.

Officers elected were F. E. Moore, president of the Mathews Conveyor Co., Ellwood City, Pa., president; Jervis B. Webb, president of the J. B. Webb Co., Detroit, vice-president; H. W. Standart, president of the Northern Engineering Co., Detroit, treasurer, and John A. Cronin, editor of *Materials Handling and Distribution*, secretary.

Companies represented at the meeting included manufacturers of cranes, hoists, conveyors, casters, gasoline and electric trucks and other equipment.

Financial News

The information contained in these financial pages is given with the understanding that any statement on the part of this magazine or any of its staff, as to the responsibility or standing of any person, firm or corporation, or as to the value of any property or securities is a mere expression of opinion, given as a matter of service to the readers of PIT AND QUARRY, *for which no responsibility in any way is to attach to this magazine or to any of its staff.*

British Cement Company Reports Good Earnings

By substantially expanding its turnover, the Francois Cementation Co., important producer in Great Britain, increased its earnings materially in 1930. Including dividends from subsidiaries, trading profits are shown in the report just issued at £67,544 ($202,700), against £28,837 ($86,600) for 1929-30, a gain of £38,707, though the actual increase is not quite so large, because this time taxation is allowed for before striking the balance, instead of after, as previously. After being maintained at 50 per cent. regularly for some years the common stock dividend was passed last year, though the preferred stock payment was made after transferring £15,000 from investment reserve.

As it is considered essential that resources should be conserved in order to build up larger reserves for the needs of the steadily expanding business and in view of the general unsettled outlook, the board is again withholding a common stock dividend. The forward balance has been raised from £38,209 to £44,330 ($114,700 to $133,100). (The conversion of pounds to American dollars is based on the current rate of exchange at New York.)

Ideal Cement Pays Its Usual Christmas Extra

Ideal Cement Co. of Denver has declared and paid an extra Christmas dividend of 25 c. a share and added unexpected cheer to the holiday season of owners of 458,271 shares of the company's stock.

In addition, the directors declared the regular quarterly payment of 50 c. a share on the corporation's stock.

The extra was payable Dec. 22, to stockholders of record Dec. 15. The regular will be paid Jan. 2, to stock of record Dec. 15. Last year the company paid an extra dividend of 50 c.

A statement by R. J. Morse, vice-president and general manager, said surplus piled by the corporation in its best years would be called upon to pay part of the dividends. Surplus is ample, he added, to pay the regular dividends throughout all of the year of 1932.

"Earnings of Ideal Cement Co. this year," said Mr. Morse, "on account of depressed prices and subnormal shipments, will not cover the regular dividend, but the directors considered that the stockholders should be given the benefit of the surplus built up during the previous prosperous years of operations.

"With the knowledge that the cash position of the corporation is such that the payment of the regular dividends of $2 per share for the year 1932 is assured, and that an extra of 25 c. per share at this time is justified, an extra Christmas dividend of 25 c. per share was declared."

The company has been paying Christmas extras to its stockholders for more than ten years.

The company disbursed $447,353.25 for bond interest and for the dividend payments authorized as above. On January 1, $103,650 in bond interest will be paid. The regular quarterly dividend amounts to $229,135.50. The extra amounts to $114,567.75.

Texas Gulf Sulphur Co. Net to Exceed Dividend

Based on results so far, earnings of Texas Gulf Sulphur Co. in the fourth quarter of the year will be in the neighborhood of 80 c. a share on the 2,540,000 shares of capital stock outstanding, covering the quarterly dividend payment at the rate of $3 by a fair margin.

In the nine months ended September 30, net profit was $6,704,091, or $2.64 a share, indicating a final net profit for the year of $3.44 a share. This would compare with a net of $13,972,085, or $5.50 a share earned in 1930, and $16,247,478, or $6.39 a share in 1929.

The decline in the sulphur business has been in line with the general decline in industrial operation, and tonnage sales are running about 40 per cent. below the 1929 peak levels. Sulphur finds its chief use in sulphuric acid, which is one of the basic chemicals used in nearly every branch of industry.

Thus while forecasts of next year's consumption can not be made with assurance, it at least seems probable that the greater part of the decline in consumption of sulphur has already occurred and that the use of sulphuric acid is now somewhere near the minimum level compatible with the essential needs of the country.

The largest consumer of acid is the fertilizer industry, which in 1930, took 2,350,000 tons out of total of 7,625,000 tons used during that year. The fertilizer business was off about 20 per cent. in 1931, probably accounting for the largest part of the decline in the use of sulphur.

The outlook for consumption from the general chemical industry now seems fairly satisfactory. Chemical plants used 820,000 tons of acid in 1930, being the third largest consumers of sulphur. Chemical activities as a whole have been reduced to a level which would seem to be close to a minimum. The same appears true of the iron and steel trades, using 660,000 tons in 1930, which operated at about 45 per cent. of capacity in the first half of this year, and about 30 per cent. in the last half, an average for 11 months of 39 per cent.

Even should industry continue during 1932 at an abnormally low level, Texas Gulf Sulphur's outlook is not unfavorable. The company is in strong cash and current asset position. Cash on hand is now in excess of $3,000,000 and sulphur inventories, carried at cost at the end of 1930, were $11,928,570, which is much less than market value. This consists of over 2,000,000 tons above ground at the three deposits, which have been accumulated as a reserve supply.

CURRENT DIVIDENDS

Company	Class of Stock	Dividend Rate	Holders of Record	Payable	Company	Class of Stock	Dividend Rate	Holders of Record	Payable
Alpha Portland Cement	Preferred	$1.75 qr.	Dec. 1	Dec. 15	National Gypsum Co	Preferred	$1.75 qr.	Dec. 15	Jan. 2
Canada Cement Co	Preferred	$1.62½ qr.	Nov. 30	Dec. 31	Pennsylvania Glass Sand	Preferred	$1.75 qr.	Dec. 16	Jan. 1
Cleveland Quarries Co	Common	$0.25 qr.	Nov. 10	Dec. 1	Pittsburgh Plate Glass	Common	$0.25 qr.	Dec. 10	Dec. 31
Giant Portland Cement	Preferred	$1.75 S.A.		Dec. 15	Raybestos-Manhattan	Common	$0.40 qr.	Nov. 30	Dec. 15
Ideal Cement	Common	$0.50 qr.	Dec. 15	Jan. 2	Republic Portland Cement	Preferred	$1.75 qr.	Nov. 23	Dec. 1
International Amiesite	Preferred	$1.75 qr.	Nov. 20	Jan. 1	Southwestern Portland Cement	Preferred	$2.50 qr.		Jan. 1
International Salt	Common	$0.75 qr.	Dec. 15	Jan. 2	Southwestern Portland Cement	Common	$1.50 qr.		Jan. 1
Johns-Manville	Common	$0.25 qr.	Dec. 26	Jan. 16	Superior Portland Cement	Class A	$0.27½M	Dec. 23	Jan. 1
Kentucky Rock Asphalt	Preferred	$1.75 qr.	Dec. 10	Jan. 2	Superior Portland Cement	Class B	$0.25 Sp.	Dec. 12	Dec. 21
Lehigh Portland Cement	Preferred	$1.75 qr.	Dec 14	Jan. 2	Texas Gulf Sulphur	Common	$0.75 qr.	Dec. 1	Dec. 15
Leslie-California Salt	Common	$0.20 qr.	Dec. 1	Dec. 15	United States Gypsum	Common	$0.40 qr.	Dec. 15	Dec. 31
McWilliams Dredging	Common	$0.37½ qr.	Nov. 15	Dec. 1	United States Gypsum	Preferred	$1.75 qr.	Dec. 15	Dec. 31
Monolith Portland Cement	Preferred	$0.40 S.A.		Jan. 2	Warner Co	1st Pfd.	$1.75 qr.	Dec. 15	Jan. 1
Monolith Portland Cement	Common	$0.40 S.A.		Jan. 2	Warner Co	2nd Pfd.	$1.75 qr.	Dec. 15	Jan. 1

Review of Foreign Practice

Lowering Water Content in Slurry with Alkalies

Attention has recently been attracted to experiments of the Russian investigators Budnikoff and Koukolew, reducing the water content of cement slurry by the addition of alkalis which facilitate decantation; a solution of 0.01 per cent. of standard Na_2SiO_3 lowered the water content from 48 to 42 per cent., and solutions of Na_2CO_3, NaOH and of molasses reduced the content from 52 to 40 per cent.

The writer of this brief note states that as long ago as 1923, while he was manager of a cement plant in Pas-du-Calais, France, the operators succeeded in reducing the water in their slurry from 42 per cent. to 35 per cent., later to 31.4 per cent., or a diminution of more than 10 per cent. of water at equal fluidity, simply by the addition of about one kilogram of sodium carbonate to each car of stone at its entrance to the washers, or about 0.7 parts in 1,000. The chart shows the results obtained in 1923, when this was begun, and later. This addition of sodium carbonate, costing less than 1 franc per cu. me. of stone, resulted in a saving in coal of around 3 per cent., and an appreciably increased output from the kilns.—M. Pelet in *Revue des Materiaux de Construction*, No. 265, pp. 407-408, Oct., 1931.

Rapid Advancement in Turkish Cement Industry

At the close of the world war there was only one cement plant in Turkey, but under the stimulus of increased demand and governmental encouragement the industry has since made great strides. In 1929 the consumption of cement in Turkey was calculated at 160,000 to 180,000 metric tons, of which 72,800 tons were imported—12,000 tons from Russia, 9,000 tons from Jugoslavia, 7,000 tons from Italy, 6,000 tons from France, 6,000 tons from Rumania, 6,000 tons from Germany and 4,000 tons from Belgium.

At present the domestic production is sufficient for all needs of the country, and there is even a little surplus. Furthermore, importation of cement in Turkey has become impossible because of the high duties on foreign cement. At the end of 1930 there were five cement plants in the country:

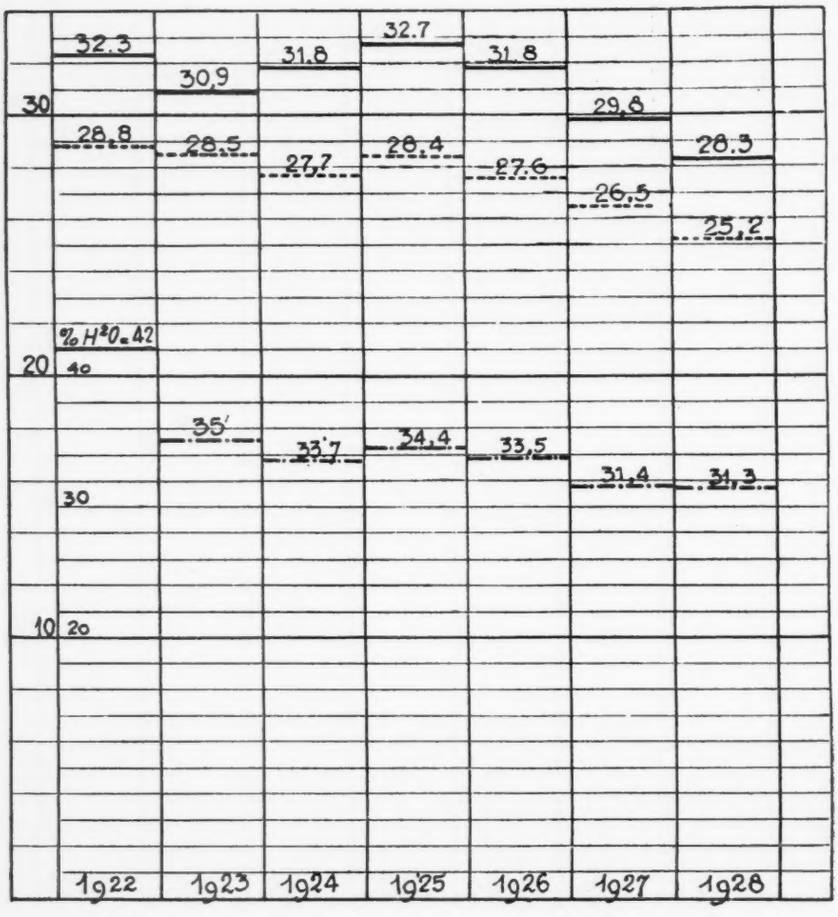
(1) Kartal plant, owned by a Belgian group. Equipped with rotary kilns, it has been provided throughout with the latest technical improvements. It went into operation in July, 1930; it has an initial capacity of 70,000 tons yearly, which can easily be doubled or even trebled.

(2) Zeitin-Bournou plant, with shaft kilns, but of the most improved design. It also has a yearly production of around 65,000 tons.

(3) Aslan-Eski-Hissar plant, the oldest in Turkey, having been established in 1910. Its equipment and manufacturing process have been brought up to date and it produces an excellent cement. Its annual output amounts to about 35,000 tons.

(4) Ankara (Angora) plant, established in June, 1928, by the prefecture of Ankara and a French group, which since has become sole owner by buying the government's interest. This plant has modern equipment and produced at the outset 20,000 tons of Portland cement and 12,000 tons of hydraulic lime; these figures have since been doubled by the addition of another automatic shaft kiln.

(5) Bakirkeny plant, established in April, 1926, for a production of only 15,000 tons annually. It makes an excellent rotary-kiln cement—*Le Ciment* 36:415, Nov., 1931.



Effect of addition of sodium carbonate in cement slurry.

Calcium-Sulphoaluminate in Hydration of Cement

In a previous article the author reported that the calcium aluminate in Portland-Cement clinker, when hydrated without the addition of gypsum, crystallizes in the form of hexagonal leaves with the composition $3CaO.\ Al_2O_3.\ 10.5H_2O$. In this article he studies the action of gypsum on the hydration of calcium aluminate in Portland cement, with a review of the previously published literature. The calcium-sulphoaluminate was isolated from commercial Portland cement and its chemical composition definitely established. On the basis of microscopic and chemical studies the investigator concludes: (1) In the hydration of Portland cement gypsum sets calcium aluminate and forms calcium-sulphoaluminate of the composition $3CaO.\ Al_2O_3.\ 3CaSO_4.\ 32.6H_2O$; (2) Calcium sulfoaluminate containing less than three molecules of gypsum does not arise in the hydration of Portland cement; (3) In time calcium-sulphoaluminate splits again into gypsum and calcium aluminate.—K. Koyanagi in *Zement* 20:1016—1021, Nov. 26, 1931.

New Machinery and Supplies

Crushing Unit for Road or Stock-Pile Service

A new type of machine has been developed by the Rogers Iron Works Co., Joplin, Mo., for picking up gravel which has been previously bladed into a windrow; elevating, crushing, screening, and returning it to the job as 100 per cent. specification material.

The machine was built with the idea of furnishing a machine which would efficiently reduce and size the material of old macadam roads for reconstruction purposes, also for the maintenance of gravel roads of all types where the accumulation of oversize material is a source of trouble to the maintenance department and a hazard to motor traffic. The machine is a self-contained, self-propelled and self-feeding unit, built in either crawler or wheel type, each type serving a distinct field.

The crawler type is better adapted to new construction where road beds may at times be soft and the tractive effort of the wheel-type machine would be inadequate. This type is furnished with a speed range of from 4½ ft. per min. working speed to 2 mi. per hr. road speed.

The wheel-type machine is more adaptable to maintenance work where a good firm road bed exists and there is no necessity for the crawler tread for added traction. This machine also has the advantages of being lighter and more mobile, its speed range being from 8 ft. per min. working speed to 10 mi. per hr. road speed.

The loading elevator is of very heavy construction. It is furnished with specially-designed boot the flaring sides of which direct the material into the path of the loader. The design of the boot is such that after having passed over the road, the surface is left clean and free from any appreciable amount of "oversize" material.

After the material is picked up by the loader it is elevated and delivered to the crusher for reduction, which discharges onto a shaker screen of ample size. The undersize product of this screen drops onto the road forming a windrow of specification material beneath the machine. The oversize material is passed forward into the boot of the loader from where it is again picked up, elevated and again delivered to the crusher where it is reduced to a size which will pass the screen. In this way a closed circuit is maintained which precludes any possibility of material being placed on the road surface which has not passed the screen.

Although the crusher is powered from the same plant which furnishes power for the movement of the machine, its operation is independent and it may be started or stopped at will.

Another feature has been incorporated in this machine consisting of a conveyor mounted beneath the screen discharge, and extending to the rear. In operation the material from the screen drops to the conveyor belt which discharges to a bucket elevator mounted at the rear, the elevator being of proper height to permit stock-piling or loading into trucks. This feature permits the use of the machine at a stock-pile or at any point where there is an accumulation of material to be crushed.

Self-propelled portable crushing plant.

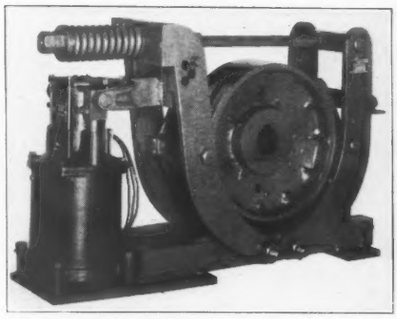
New Shoe-Type Thrustor Brakes for A. C. Motors

The General Electric Co. announces a new line of shoe-type, weather-proof, Thrustor - operated brakes (Type CR9516) for alternating-current motors on mill, crane, hoist and similar applications where severe service requirements must be met. These brakes provide quick, cushion-like braking in either direction of rotation with either light or heavy loads, and are adjustable for braking torque over a wide range.

The characteristics of the Thrustor make it particularly well adapted as an operating medium. It operates well within the time required to release and set a brake satisfactorily. In a fraction of the time required for the Thrustor to move through its complete stroke, the motor comes up to full speed and the speed of thrust remains constant during the remainder of the stroke. The uniform speed characteristic also results in a smooth, cushion-like setting when the brake is de-energized. The use of the Thrustor minimizes braking mechanism inertia, shock and noise.

On many crane applications, jogging within a fraction of an inch of hook travel is required. With a Thrustor brake, the motor armature may be rotated when jogged as little as 1/20th of a revolution.

In many installations, such as on the bridge and trolley motions of a crane where the load is of such nature that a large amount of energy must be expended, it is not desirable to have the brake set immediately after power has been removed from the motor. Time delay for setting between 1 and 20 seconds or more if necessary, can be furnished by the provision of a small valve inside the Thrustor tank. Adjustment of this valve can be made externally on the smaller size Thrustors by means of a small screw on the tank. Adjustments on the larger sizes are made from the inside of the tank. The torque setting, which varies with the spring compression, is readily adjustable.

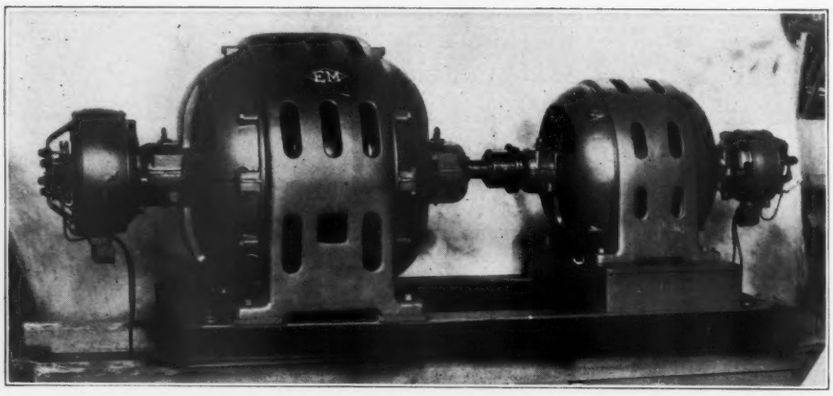


Spring-set, Thrustor-operated brake.

Frequency-Changer Sets for Vibrator Equipment

To provide means of obtaining alternating current at frequencies either above or below those of the usual 60-cycle source, the Electric Machinery Manufacturing Co., Minneapolis, Minn., offers a line of synchronous-motor-driven frequency changers. Typical examples of equipment requiring special frequencies are vibrators, vibrator conveyors, and welding machines.

The set illustrated furnishes power



Frequency-changer set for operating vibrator machines.

for thirteen vibrating conveyors. The motor is rated 50 hp. to operate on 60-cycle current at unity power factor. The alternator is rated 125 Kv-a. to deliver 30 cycle current. The power factor of the load on the alternator is very low and the latter is designed to carry 25 k-w. at 20 per cent. lagging power factor. The speed which gives lowest first cost with this combination of frequencies is 900 r.p.m. and the set was built accordingly, the motor having eight poles and the alternator four poles.

In order that the generator excitation may be varied without changing the motor excitation, each machine is furnished with its own exciter which is direct-connected to the shaft.

The low power factor of the load is not transmitted back to the plant supply system as it is carried by the alternator. Rather the set has the effect of raising the plant power factor due to the unity power factor characteristic of the synchronous motor. If desired the motor may be designed for leading power factor operation with more power factor corrective effect.

Frequency changer sets can be supplied to give any frequency desired for the operation of special commercial apparatus.

Automatic Cement Scale Has Cylindrical Hopper

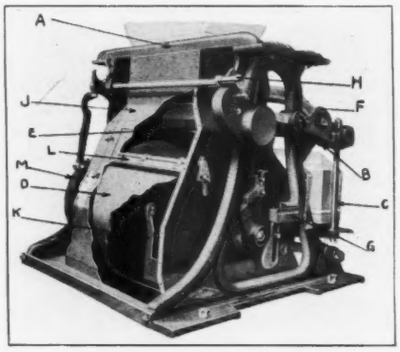
The Libra Type U automatic cement scale differs from the ordinary type of automatic scale with tipping hopper or bottom discharge. It is an entirely new development and is provided with a cylindrical weighing hopper, with one opening to receive and discharge the load.

The inlet gate is of the usual type, and the scale is provided with a special adjusting device, which obviates the use of knife and pan bearings, the cylindrical hopper being well supported by properly lubricated trunnions. A counter is provided to register accurately the weight of each load.

As with all Libra scales the Type U is provided with a preliminary feed to insure rapidity of operation, which is followed by a fine dribble when nearing perfect balance.

Unlike scales with tipping hopper or bottom discharge, the scale may be regulated for any weight desired, by changing the weighing weights on the platform *C* shown in the accompanying illustration.

It is practically noiseless, thus avoiding the vibrations set up with some scales and is eminently applicable for mixing purposes, as the weighings may be changed at will. It



The automatic scale.

is especially designed for handling dusty materials like cement, as the scale is entirely inclosed.

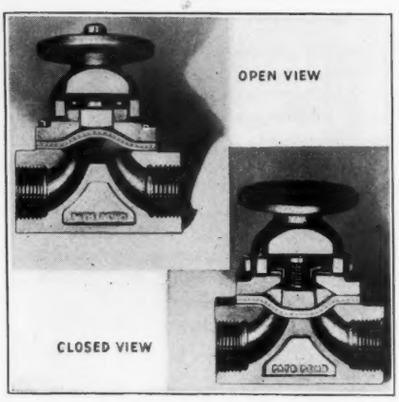
It has already been adopted by some of the largest cement plants in Europe, and they have given complete satisfaction.

On receipt of complete data giving capacity required, nature of the cement to be weighed, and other similar information, an estimate may be promptly obtained by writing Ernest H. DuVivier, American representative, 30 Church St., New York, N. Y. The scale is manufactured under rights controlled by the Libra Scale Co. of Gliesmarode, Brunswick, Germany.

New Valve Type Has No Metal-to-Metal Contact

The Hills-McCanna Co., Chicago, Ill., has acquired the manufacturing and sales rights on a new valve designed and perfected by P. K. Saunders, a mining engineer in South Africa. The valve was originally intended to eliminate leaks in water and air lines that caused a large unnecessary expense each year. Ordinary valves with metal to metal seats often have not been satisfactory due to scale and other foreign substances settling on the seats preventing a tight closure.

The valve perfected by Mr. Saunders, has no metal-to-metal seats, no stem packing or stuffing boxes, and is recommended for general service. The materials handled never reach the valve bonnet. The diaphragm protects all the working parts from the substances handled. This is an important feature when handling volatile liquids, gases and air, liquids having gritty solids in suspension and



Sectional views of the valve.

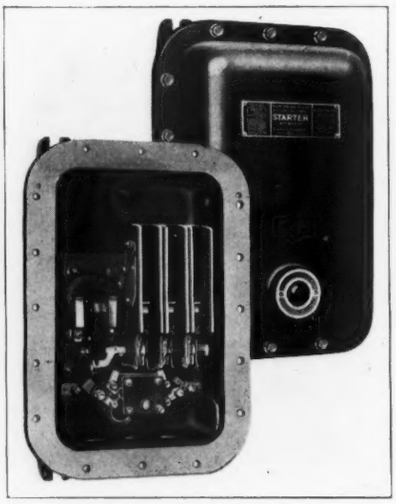
corrosive liquids. Access to the bonnet or body does not require removal from the line. Corrosion-resistant valves of any commercial material are priced in the range of iron valves due to the design that requires only the body to be cast in special metals.

In the closed position the diaphragm is compressed between the compressor follower and the seat. An even distribution of pressure on the diaphragm is secured through proper design and machining of the seat and compressor.

Automatic Starter for Explosive Atmospheres

Cutler-Hammer, Inc., 292 N. 12th St., Milwaukee, Wis., announce a new, explosion-proof, across-the-line type,

(Continued on page 85)



Explosion-proof, across-the-line starter.

Manufacturers' Publications

Each publication listed below contains information of interest to nonmetallic mineral producers. Readers may obtain, without charge—except where a price may be stated—and without obligation, copies of any of these publications by writing directly to the manufacturers who publish them. Please mention PIT AND QUARRY *when writing.*

Air Compressors

Portable Air Compressors. 16 p. (Bull. C-32. O. K. Clutch & Machinery Co., Columbia, Pa.) Describes and illustrates two sizes of portable air compressors having piston displacements of 120 and 240 cu. ft. per min. Features of the machine are the interchangeability of all parts with the exception of cylinder blocks, crank-cases and crankshafts.

Belting

Pacemaker—the Belt with a World of Service. 8 p. (The Cincinnati Rubber Manufacturing Co., Cincinnati, O.) An illustrated folder describing a line of rubber-cotton transmission belting. Contains data on the care of belts and a number of handy belt rules and formulæ.

Cars

Economics and Economy. 4 p. (Sanford-Day Iron Works, Inc., Knoxville, Tenn.) Points out in text and illustrations the salient points of this company's line of mine and quarry cars, including automatic-dump, rotary, and end-dump types.

Electrical Equipment

Floodlighting for Outdoor Construction. 4 p. (General Electric Co., Schenectady, N. Y.) Contains the report of the Committee on Light and Safety, Illuminating Engineering Society, pointing out the various factors which govern the economical installation of floodlights for industrial operations.

CR 7006-D40 Magnetic Switch. 2 p. (Bull. GEA-841B. General Electric Co., Schenectady, N. Y.) Describes and illustrates an across-the-line magnetic-switch starter for induction motors employing temperature-overload and undervoltage protectors. Fine-silver contacts are said to eliminate contact resistance losses.

Gears

G-E Fabroil Gears and Gear Blanks. 4 p. (Bull. GEA-1236A. General Electric Co., Plastics Dept., Schenectady, N. Y.) Describes and illustrates gears and gear blanks of nonmetallic materials for which quiet operation, long life and low upkeep expense are claimed.

Pulverizers

Two Operations in One. 4 p. (Raymond Bros. Impact Pulverizer Co., Chicago, Ill.) Describes and illustrates the construction and operation of the Raymond kiln mill which combines the two operations of pulverizing and drying. Utilizes waste heat in the drying process, if available, and produces a uniformly fine, dry product.

Pumping, Automatic

Automatic Pumps Equipped with Automatic Control. 4 p. (The Electric Controller & Manufacturing Co., Cleveland, O.) Describes and illustrates a system for the electric control of pumping systems, which enables one or more pumps to be stopped or started as required.

Washers

Washing Equipment. 12 p. (Bull. 1471. Allis-Chalmers Manufacturing Co., Milwaukee, Wis.) Describes and illustrates the complete line of washing equipment for producers of nonmetallic minerals including scrubbers, logs, screw sand washers, scrubber screen and vibrating screens. Particular attention is directed to the stone scrubber because of the growing tendency for washing crushed stone.

Weir-Kilby Absorbs Frog and Switch Firm in Ohio

The Weir Kilby Corp., of Cincinnati, O., and Birmingham, Ala., manufacturer of railway, mine and industrial track work, has acquired the Cincinnati Frog & Switch Co., of Cincinnati. The former president of the Cincinnati Frog & Switch Co., Charles H. Partington, has resigned and O. DeG. Vanderbilt, Jr., president of the Weir Kilby Corp., has been elected president of the Cincinnati Frog & Switch Co., also. The business of the Cincinnati Frog & Switch Co., will be carried on as in the past.

New Automatic Starter

(Continued from page 84)

a.-c. automatic starter, designed in accordance with the specifications of the Underwriters' Laboratories for class 1, group D hazardous locations. These specifications include applications where explosive gas or dust is prevalent in the atmosphere. This new starter is of the air-break type—all contacts are made and broken in the air—there is no oil tank. The heavy cast-iron, explosion-proof, enclosure is designed to prevent any explosion which might occur within it, from igniting the surrounding explosive atmosphere.

The construction of the starter proper consists of a standard 3-pole, magnetic contactor, with C-H thermal overload relays to protect the motor from burnout due to overloads.

The enclosing case is of the "split" type, which, when opened, allows easy access to all parts of the starter. Extra wide and accurately machined flanges are provided between the cover and case.

These starters are designed in three sizes, to take care of motors up to 30 hp., 220 volts; and 50 hp., 440 or 550 volts.

Advertising Campaign Lays Emphasis on Waterproofed Cements

The Medusa Portland Cement Co. of Cleveland, O., is winning larger sales volume for its waterproofed Portland cements (white and gray) with an interesting series of advertisements running in several national magazines, according to M. W. Waples, advertising manager, in an article in *Class & Industrial Marketing.*

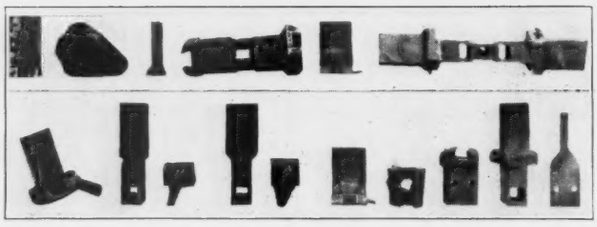
The rapidly growing use of waterproofed Portland cements, both white and gray, in concrete, stucco and mortar led the company to believe that these cements should be widely advertised, using a distinctive type of advertising. It felt that the old conventional practice of displaying illustrations of successful jobs would not do. It was absolutely essential that the campaign get across to the reader something more than just a trademark and a trade name, inasmuch as the Medusa trademark and trade name were already widely associated with the company's gray Portland cement. It was necessary that the copy be read. It needed to attract favorable attention to the outstanding advantages of concrete, stucco, or mortar made with a waterproofed Portland cement.

Modernistic art treatment was chosen for attention value and because it would lend itself to dramatizing the story. Medusa waterproofed cements are shown personified throughout the series by a gigantic figure whose bold angles and contours suggest concrete. The appeal was divided between home and general construction (the product being used for both purposes), in every case stressing the advantages of concrete, stucco, and mortar that would be impervious to moisture. Featured throughout the campaign are two slogans, "Originated by Medusa—Proved by Time" and "Successful for 21 Years." In every advertisement the reader is invited to send for the book, "How to Make Good Waterproofed Concrete." In addition to this campaign on waterproofed Portland cements, Medusa has devoted much advertising space to another specialty, Medusa Portland-cement paint.

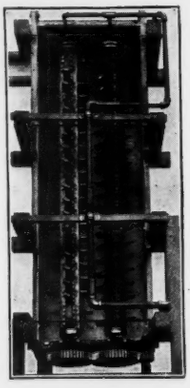
Medusa's success in advertising its Portland-cement specialties has not only expanded the sales of these products but has reflected itself in stimulating the sales of standard Portland cement through added prestige.

Announcing
THE NEW
CEDAR RAPIDS
-336-
HEAVY DUTY
REDUCTION CRUSHER
Increased production at a minimum cost, is the problem of all material producers today. The "New Heavy Duty 'Cedar Rapids' 336 Reduction Crusher" is solving this problem for both the stationary and portable plant operators. Double your daily capacity by adding one or more Cedar Rapids Reduction Crushers to your plant equipment. In the "Cedar Rapids' Line" you will find equipment to solve your material handling problem. Write us today for our special 336 circular and also a copy of our general catalogue.
See us at the Road Show—Space 227—Section F
Made by
Iowa Manufacturing Company
Cedar Rapids, Iowa

Absolutely clean products means greater demand at higher prices.
Cut stripping costs—Remove tough clays and soft rock.



That's what happens by using the improved McLanahan log washer. Replacements easily and quickly made. Let us send our catalog of complete washing machinery for washing limestone, sand and gravel and other products.



McLanahan and Stone Corporation
MANUFACTURERS FOUNDERS MACHINISTS
Hollidaysburg (Established 1835) Pennsylvania

Free Book of Useful Ideas

On Excavating, Storing and Reclaiming

If you are interested in reducing the cost of excavating, handling or storing your bulk materials, send for this 72-page booklet. It gives you over 100 pictures, drawings and descriptions of how Sauerman Power Drag Scrapers are solving material handling problems. A post card is enough to tell us where to send the booklet. Just say: "Send Catalog No. 14."

SAUERMAN BROS., Inc.
434 South Clinton Street
Chicago, Illinois

A SAMPLE will TELL

Send us a sample of your sand and we will tell you just what grade or grades of sand you can expect from your bank—the quantity of water required for washing and the most effective installation to use.
ALLEN CONES or TANKS, operating in series, will give you two or more grades of accurately classified sand.

Write for details

ALLEN CONE & MACHINERY CORP.
ENGINEERS
30 Church Street, New York City

Allen Sand Tank

Pit and Quarry

With which is consolidated

CEMENT-MILL & QUARRY

Member Audit Bureau of Circulations

Read in Largest Number of Plants

The First Paper Devoted to the Production of Non-Metallic Minerals

Vol. XXIII | December 30, 1931 | No.

The Great Opportunity of 1932

The year 1931 showed us, as no other year did, the high cost of destructive competition; the frightful waste of "business at any price." It emphasized the perils of adversity and, in doing so, showed us business and business men at their worst. Before then price-cutting, secret concessions, misrepresentation and mistrust were but the names of evil tendencies; last year they became prominent characteristics of business practice.

The new year offers us, among other things, the opportunity to rectify these errors, to return business to the plane of conservatism and sound judgment. Because business is slack must men sacrifice all the principles of profitable production, right dealing, respect for and confidence in their competitors, which have made business profitable and pleasurable? Must the spirit of coöperation, which has made possible the greatest achievements of business, be forsaken for the rampant individualism of the past year, just because conditions may be temporarily unfavorable? Are not these reactions to disappointing circumstances merely the result of fear, doubt and uncertainty? Have they any justification in reason, or can they meet the test of results?

In the past year business men have drawn apart from each other more and more, as their fear and suspicion increased, and they have countenanced methods which, if persisted in, may in time make a return to our customary harmonious coöperation impossible. For as we withdraw more and more from contact with our fellow business men, we lose more and more of that confidence, sympathy and understanding which put the joy and the compensation into good work well done.

Let us have more friendly coöperation in 1932. It is a new year; why not make it a better one? Let us have more sharing of burdens, responsibilities and problems, more sympathy for competition, more understanding of our common aims. By all means let us have greater support for those powerful agencies, such as our trade associations, which promote coöperative effort by directing attention to common problems and common gains. Let us have a return of old-time faith, old-time cheer, and (as a result) old-time prosperity.

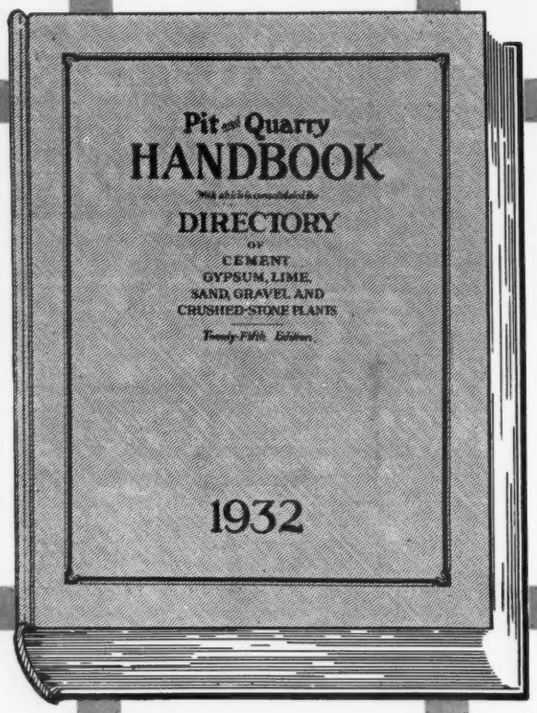
Vice-President and Directing Editor

SINCE SEPT. 11, 1929, LARGEST NET PAID CIRCULATION IN THE FIELD

(See A. B. C. Audit Reports for Details)

Ready Jan. 15th

The New 1932 Handbook

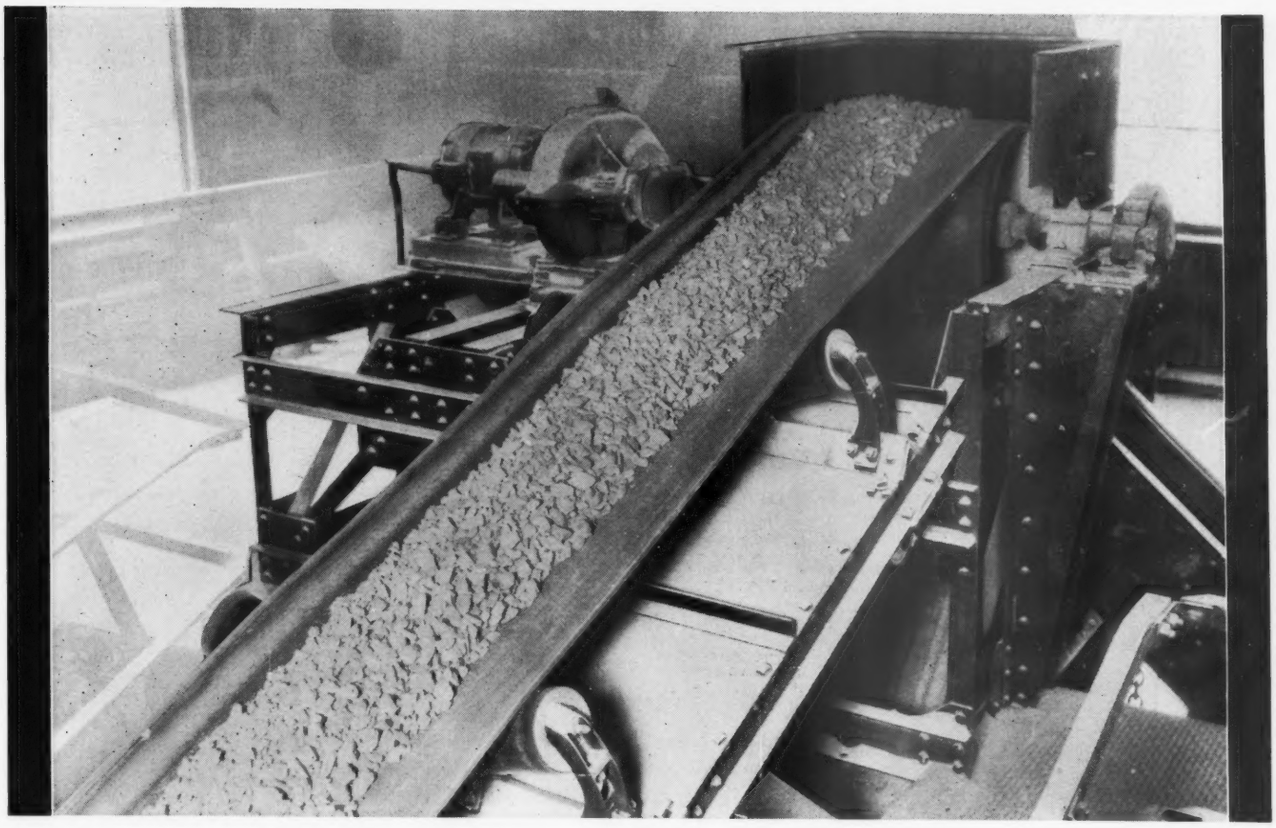


$5.00 Per Copy

Order Now

Pit and Quarry Publications

538 So. Clark St. Chicago, Ill.



S-A Belt Conveyors . . .

Built to Meet Emergencies

Hundreds of users will testify that S-A belt conveyors are dependable. S-A engineers know the knocks and bumps conveyors are bound to get and build them to stand the racket.

Two of the eight S-A belt conveyors, used in a large crushing and screening plant, to carry stone from screen house to huge storage piles.

Each detail is carefully planned and checked by men who have had years of field experience. Operating conditions are studied and every detail considered, not only for present conditions, but also for future emergencies.

The S-A carriers upon which the heavily loaded belts roll are but one of the features of S-A conveyors. The rollers must be carefully finished and must turn freely to reduce belt wear and tension. The heavy ball or roller bearings must be easy to lubricate and must be thoroughly protected from dirt, grit and water. The carrier frames must be rigid and carefully designed to eliminate all chance for broken parts and injury to expensive belts.

No detail that will increase the life and service of S-A conveyors is overlooked.

Write us. An S-A engineer will be glad to call and suggest conveyor arrangements to save you time and money.

Stephens-Adamson Mfg. Co., Main Office—Aurora, Illinois. Factories at Aurora, Illinois; Los Angeles, California; Belleville, Ontario. Branch offices in principal cities.

Stephens-Adamson

BELT CONVEYORS, FEEDERS, ELEVATORS, SCREENS AND TRANSMISSION MACHINERY

Classified Buyers' Guide

A Directory of PIT AND QUARRY Advertisers Arranged According to Product

Although every effort is made to insure accuracy and completeness in these listings, the publisher cannot accept responsibility for errors or omissions. Any mistakes discovered will gladly be rectified, if brought to the attention of the Advertisers' Service Department.

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Eagle Iron Works

Agitators, Thickeners and Slurry Mixers
Traylor Eng. & Mfg. Co.

Air Compressors
Fuller Co.
Traylor Eng. & Mfg. Co.

Air Pumps
Fuller Co.

Air Separators
Gay Co., Inc., Rubert M.
Gruendler Crusher and Pulverizer Co.
McGann Mfg. Co.
Northern Blower Co.
Raymond Bros. Impact Pulv. Co.
Universal Road Machinery Co.

Ash- and Refuse-Handling Equipment
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Stephens-Adamson Mfg. Co.

Automatic Feeders
Stephens-Adamson Mfg. Co.

Automatic Weighers
Merrick Scale Mfg. Co.

Barges (Steel)
Norbom Engineering Co.

Bearings (Anti-Friction)
Stephens-Adamson Mfg. Co.

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Morrow Mfg. Co.
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McLanahan and Stone Corp.
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Blasting Supplies
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Norbom Engineering Co.
Sauerman Bros.

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Borings, Core
Pennsylvania Drilling Co.

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Buckets (Clamshell, Orange Peel, Etc.)
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Sauerman Bros.
Wellman Engineering Co.

Buckets (Elevator and Conveyor)
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Smith Engineering Works
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Stephens-Adamson Mfg. Co.

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Stephens-Adamson Mfg. Co.

Chain Drives
Stephens-Adamson Mfg. Co.

Chutes and Chute Liners
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Raymond Bros. Impact Pulv. Co.

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Cranes (Overhead Traveling Electric)
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Williams Patent Crusher and Pulverizer Co.

Crushers (Jaw and Gyratory)
Gruendler Crusher and Pulverizer Co.
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Smith Engineering Works
Traylor Eng. & Mfg. Co.
Universal Road Machy. Co.
Williams Patent Crusher & Pulverizing Co.

Crushers (Rotary)
Ehrsam & Sons Mfg. Co., J. B.

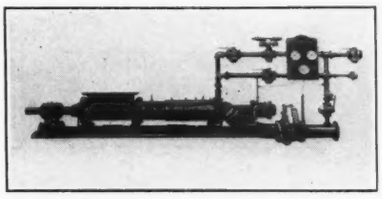
Crushers (Roll)
Gruendler Crusher and Pulverizer Co.
McLanahan and Stone Corp.

Crushing Rolls
McLanahan and Stone Corp.
Traylor Eng. & Mfg. Co.

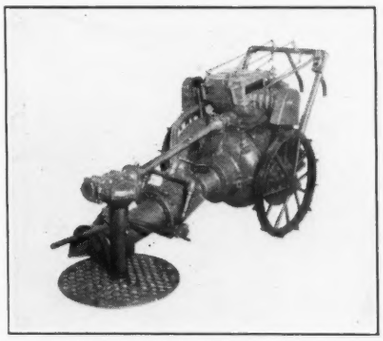
Derricks and Derrick Fittings
Harnischfeger Corp.

Diesel Engines (See Engines—Diesel)

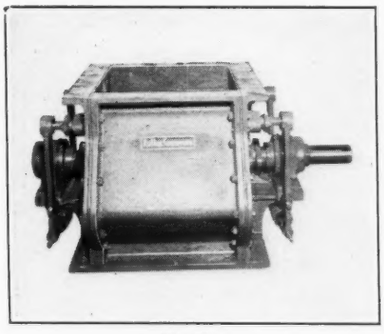
A COMPLETE EQUIPMENT FOR THE HANDLING OF PULVERIZED MATERIAL



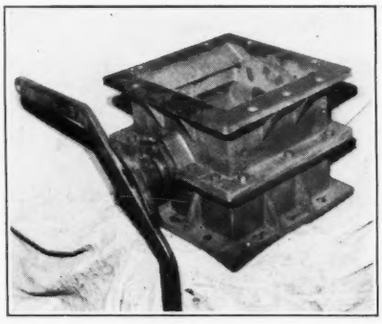
Fuller-Kinyon Pumps



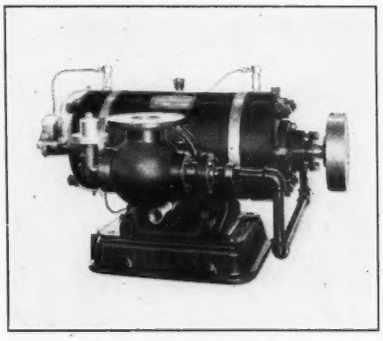
Unloading Pumps



Feeders



Bin Gates



Rotary Compressors

To keep pace with the recent peculiar demands of production and shipping, the Fuller Company has developed or acquired a complete line of materials handling equipment to anticipate the requirements of both producers and users of pulverized and ground materials. The increasing volumes of bulk shipments, forced by economic reasons, have produced entirely new ideas in conveying. At the mill, portable pumps for withdrawing cement from silos permit immediate shipments of special, tested or standard cements without contamination or delay. Large inventories are avoided in a number of plants by the use of water-cooled cement transport lines. Standard cars are loaded to a flat level without hand trimming or dust loss.

Many consumers of cement throughout the United States are obtaining the fullest economy of bulk shipments with Fuller-Kinyon portable unloading pumps. These installations are unloading standard box cars, houseboat and deep-draft barges, as well as canal boats with a minimum of effort and labor. General contractors have shown an active interest in these new portable systems in view of their adaptability to any job.

A large number of bulk cement carrying vessels, loaded and unloaded by means of Fuller-Kinyon Systems, are expanding markets for cement companies on the Atlantic Coast and inland waterways.

Many dry process cement mills are producing cement of the highest possible quality and uniformity by timed, automatically controlled Fuller-Kinyon Mixing and Blending Systems.

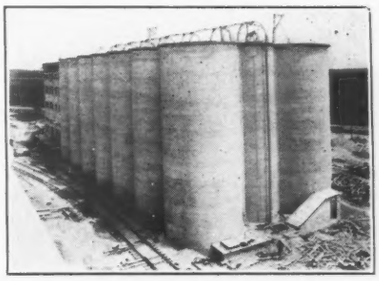
For bulk shipments of fine, crushed and granular materials, other than cement, we recommend our pneumatic conveyor, the "Airveyor." These systems are available in suction, pressure and combined types, and handle the finest dust without loss.

Non-flooding feeders are available for fine, crushed and granular materials. The feeder illustrated accurately measures fine products, including cement, lime and raw materials, without flooding.

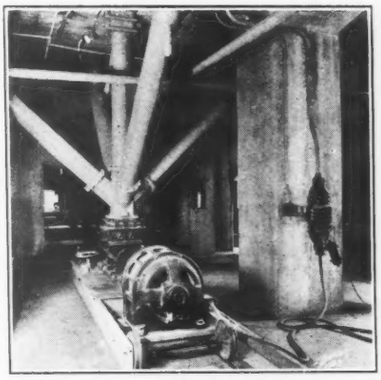
Slide gates, with the attendant leaking and sticking, are rapidly being supplanted by Fuller Rotary Bin Gates.

Fuller Rotary, single and two-stage air compressors are available for all plant requirements. Their small size, lack of vibration and direct drive are among their unique advantages.

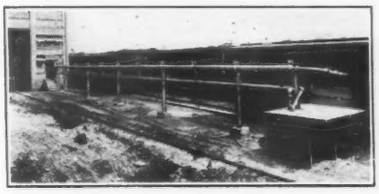
Fuller Company
CATASAUQUA, PENNA., U.S.A.



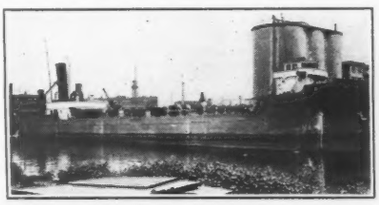
Silo Filling



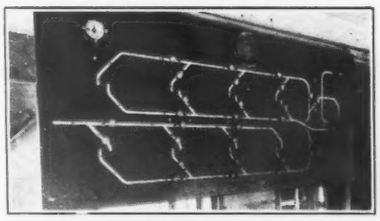
Silo Withdrawal



Bulk Car Loading



Marine Installations



Dry Blending

Pneumatic Conveyors

Classified Buyers' Guide

A Directory of PIT AND QUARRY Advertisers Arranged According to Product

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Dippers and Teeth (Power-Shovel)
Harnischfeger Corp.

Dragline Cableway Excavators
Sauerman Bros.

Dragline Excavators
Harnischfeger Corp.

Dredge Chain (See Chain)

Dredge Pipe (See Pipe)

Dredges
Morris Machine Works
Nordom Engineering Co.

Drilling Accessories
Loomis Machine Co.

Drilling Contractors
Pennsylvania Drilling Co.

Drills (Blast-Hole)
Loomis Machine Co.

Drills, Diamond
Pennsylvania Drilling Co.

Drills (Rock)
Loomis Machine Co.

Drills (Well) (See Drills—Blast-Hole)

Dryers
Iowa Mfg. Co.
Lewistown Fdry. & Mach. Co.
McGann Mfg. Co., Inc.
McLanahan and Stone Corp.
Traylor Eng. & Mfg. Co.

Dust Arrestors
Northern Blower Co.

Dust-Collecting Systems
Raymond Bros. Impact Pulverizer Co.
Northern Blower Co.

Dust Conveying Systems
Fuller Co.
Northern Blower Co.

Dynamite (See Explosives)

Elevators (See Conveyors and Elevators)

Elevator Belting (See Belting)

Engineers
Allen Cone and Machy. Corp.
Fuller Co.
Iowa Mfg. Co.
McLanahan and Stone Corp.
Stephens-Adamson Mfg. Co.

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Superior Engine Co.

Engines (Steam)
Morris Machine Works

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Fans, Exhaust
Northern Blower Co.

Feeders
Fuller Co.
Iowa Mfg. Co.
Morrow Mfg. Co.
Smith Engineering Works
Stephens-Adamson Mfg. Co.
Williams Patent Crusher & Pulverizer Co.

Forgings (Steel)
Harnischfeger Corp.

Fuses (Detonating)
Ensign-Bickford Co.

Gasoline Engines (See Engines—Internal-Combustion)

Gates (Bin) (See Bin Gates)

Gelatin (See Explosives)

Generators (See Motors and Generators)

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Lewistown Foundry & Machine Co.

Grab Buckets (See Buckets—Clamshell, Orange-Peel, etc.)

Grinding Balls (See Balls, Grinding)

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Eagle Iron Works
Iowa Mfg. Co.
Lewistown Fdy. & Mach. Co.
Smith Engineering Works
Stephens-Adamson Mfg. Co.
Traylor Eng. & Mfg. Co.
Universal Road Machy. Co.

Guns (Hydraulic)
Binks Mfg. Co.
Georgia Iron Works
Taylor Forge and Pipe Works

Gypsum Plaster Plants
Ehrsam & Sons Mfg. Co., J. B.

Hammer Mills (See Crushers—Hammer)

Hoists
Harnischfeger Corp.
Iowa Mfg. Co.
McLanahan and Stone Corp.
Sauerman Bros.
Smith Engineering Works
Stephens-Adamson Mfg. Co.

Hose Couplings (See Couplings)

Hydrators (Lime)
McGann Mfg. Co., Inc.

Hydraulic Guns (See Guns—Hydraulic)

Idlers
Smith Engineering Works
Stephens-Adamson Mfg. Co.

Kettles (Calcining)
Ehrsam & Sons Mfg. Co., J. B.

Kilns and Coolers (Rotary)
McGann Mfg. Co., Inc.
Traylor Eng. & Mfg. Co.

Kilns (Vertical)
McGann Mfg. Co., Inc.

Lime-Handling Equipment
Fuller Co.
Iowa Mfg. Co.
McGann Mfg. Co.
Raymond Bros. Impact Pulv. Co.
Stephens-Adamson Mfg. Co.

Lime Kilns
McGann Mfg. Co., Inc.

Lime and Hydrating Plants
McGann Mfg. Co., Inc.

Linings (Ball- and Tube-Mill) (See Mill Liners and Linings)

Loaders and Unloaders
Fuller Co.
Harnischfeger Corp.
Stephens-Adamson Mfg. Co.

Locomotives (Diesel)
Mid-West Locomotive Works

Locomotives (Diesel-Electric)
Mid-West Locomotive Works

Locomotives (Gas-Electric)
Mid-West Locomotive Works

Locomotives (Oil-Electric)
Mid-West Locomotive Works

Locomotives (Electric, Gas and Steam)
Brookville Locomotive Co.
Mid-West Locomotive Works

Magnetic Clutches (See Clutches, Magnetic)

Mills (Grinding) (See also Crushers—Hammer)
Allen Cone and Machy. Corp.
Ehrsam & Sons Mfg. Co., J. B.
Lewistown Fdy. & Mach. Co.
Raymond Bros. Impact Pulv. Co.
Traylor Eng. & Mfg. Co.

Mixers, Plaster, Fiber, and Retarder
Ehrsam & Sons Mfg. Co., J. B.

Motors (Internal-Combustion) (See Engines — Internal-Combustion)

Nozzles (Hydraulic) (See Guns—Hydraulic)

Nozzles (Suction Screen)
Binks Mfg. Co.

Ore Separators
Allen Cone and Machy. Corp.

Oxygen (Liquid) (See Liquid Oxygen)

Perforated Metals
Chicago Perforating Co.
Morrow Mfg. Co.

Pipe, Dredge (Floating and Shore)
Taylor Forge and Pipe Works

Pipe Flanges
Georgia Iron Works
Taylor Forge and Pipe Works

Plug Valves (See Valves)

Pneumatic Drills (See Drills, Rock)

Portable Conveyors
Fuller Co.
Iowa Mfg. Co.
Stephens-Adamson Mfg. Co.

The Fifteenth Annual Convention

OF THE

National Crushed Stone Association

WILL BE HELD AT THE

William Penn Hotel
Pittsburgh
Pennsylvania
January 19, 20
21, 22, 1932

Pittsburgh in 1932

¶ In conjunction therewith the Manufacturers' Division will hold its annual Exposition of Quarry Equipment and Machinery which has come to be recognized as one of the outstanding events of the meeting.

¶ Make your plans now to attend this annual foregathering of the crushed stone industry.

¶ All crushed stone producers of the United States and Canada, regardless of whether or not they are members of this Association, are most cordially invited to be present at Pittsburgh and share with us the many pleasures and benefits of the Convention.

For Further Information Address

THE NATIONAL CRUSHED STONE ASSOCIATION
1735 Fourteenth Street, N.W.
WASHINGTON, D. C.

Classified Buyers' Guide

A Directory of PIT AND QUARRY Advertisers Arranged According to Product

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Raymond Bros. Impact Pulverizer Co.

Pulverizers (See also Crushers; Mills; etc.)
Gruendler Crusher and Pulverizer Co.
Lewistown Foundry & Machinery Co.
Raymond Bros. Impact Pulverizer Co.
Williams Patent Crusher and Pulverizer Co.

Pump Valves (See Valves, Pump)

Pumps (Air Lift)
Fuller Co.

Pumps (Bulk Cement)
Fuller Co.

Pumps (Cement Slurry)
Morris Machine Works

Pumps (Centrifugal)
Allen Cone and Machy. Corp.
Georgia Iron Works
Morris Machine Works
Norbom Engineering Co.

Pumps (Dredging)
Georgia Iron Works
Morris Machine Works
Norbom Engineering Co.

Pumps (Sand and Gravel)
Allen Cone and Machy. Corp.
Georgia Iron Works
Kansas City Hay Press Co.
Morris Machine Works
Norbom Engineering Co.

Pumps (Vacuum)
Fuller Co.

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Ready-Mixed Concrete Plants
Stephens-Adamson Mfg. Co.

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McLanahan and Stone Corp.
Smith Engineering Works
Stephens-Adamson Mfg. Co.

Sand-Settling Tanks
Allen Cone and Machy. Corp.
Iowa Mfg. Co.
Smith Engineering Works
Stephens-Adamson Mfg. Co.

Scrapers (Power Drag)
Iowa Mfg. Co.
Sauerman Bros.

Screens
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Chicago Perforating Co.
Deister Machine Co.
Eagle Iron Works
Ehrsam & Sons Mfg. Co., J. B.
Gay Co., Inc., Rubert M.
Gruendler Crusher and Pulverizer Co.
Iowa Mfg. Co.
Lewistown Foundry & Machinery Co.
McLanahan and Stone Corp.
Morrow Mfg. Co.
Smith Engineering Works
Stephens-Adamson Mfg. Co.
Traylor Eng. & Mfg. Co.
Universal Road Machinery Co.

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Deister Machine Co.
Gay Co., Inc., Rubert M.
Gruendler Crusher and Pulverizer Co.
Iowa Mfg. Co.
Lewistown Foundry & Machinery Co.
McLanahan and Stone Corp.
Stephens-Adamson Mfg. Co.
Williams Patent Crusher and Pulverizer Co.

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Sheaves
Eagle Iron Works
Gruendler Crusher and Pulverizer Co.
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Shovels (Electric, Internal-Combustion, and Steam)
Harnischfeger Corp.

Skip Hoists and Skips
Stephens-Adamson Mfg. Co.

Speed Reduction Units
Iowa Mfg. Co.
Stephens-Adamson Mfg. Co.

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Sprockets and Chain
Iowa Mfg. Co.
Stephens-Adamson Mfg. Co.

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Steel Grating (See Grating, Steel)

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Stephens-Adamson Mfg. Co.

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Morrow Mfg. Co.
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Stephens-Adamson Mfg. Co.

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Stephens-Adamson Mfg. Co.

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Unloaders (Box-Car)
Fuller Co.
Stephens-Adamson Mfg. Co.

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Taylor Forge and Pipe Works

Variable Speed Reducers or Transmissions
Stephens-Adamson Mfg. Co.

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Washers (Sand, Gravel, and Stone)
Allen Cone and Machy Corp.
Eagle Iron Works
Iowa Mfg. Co.
Lewistown Foundry & Machinery Co.
McLanahan and Stone Corp.
Smith Engineering Works
Stephens-Adamson Mfg. Co.
Traylor Eng. & Mfg. Co.
Universal Road Machinery Co.

Weighing Equipment (Automatic)
Merrick Scale Mfg. Co.

Well Drills (See Drills—Well)

Wheels (Car)
Eagle Iron Works
Iowa Mfg. Co.

Winches and Capstans
Stephens-Adamson Mfg. Co.

Worm Gears (See Gears and Pinions)

ANNOUNCING . . . . . .

The Sixteenth Annual Convention

National Sand and Gravel Association

WILLIAM PENN HOTEL — PITTSBURGH, PA.

January 27, 28, 29, 1932

▲ ▲ ▲

A cordial invitation to attend this Convention is extended to every established sand and gravel producer in the United States and Canada.

Railroads have granted a reduction in fares, amounting to one-quarter of the regular round-trip rate, to those who will go to Pittsburgh for this Convention.

▼ ▼ ▼

FOR FULL INFORMATION WRITE TO

NATIONAL SAND AND GRAVEL ASSOCIATION

545 MUNSEY BUILDING WASHINGTON, D. C.

"the most economical crushers we have ever used in our plants"

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PRESIDENT

HARRY GUY CAMPBELL, C. E.
TREASURER

HARRY T. CAMPBELL SONS' CO., INC.
Engineers Contractors Quarrymen
CRUSHED AND BUILDING STONE
ROAD BUILDERS
TOWSON, MARYLAND

TELEPHONES { TOWSON 500 / TUXEDO 2046

QUARRIES:
No. 1. Texas, Md., Penna. R. R.
No. 2. Rustic Stone, Valley Road
No. 3. Face Stone, Butler, Md.
No. 4. Gwynns Falls, Baltimore City
No. 5. Texas Marble Quarry Texas, Md.

November 24, 1930

Mr. D. D. Barnes,
Smith Engineering Works,
Capitol Drive at Holton St.,
Milwaukee, Wisc.

Dear Sir:

In answer to your request of November 18th, I am more than glad to recommend Telsmith equipment. We have found it very satisfactory and the most economical crushers that we have ever used in either of our plants.

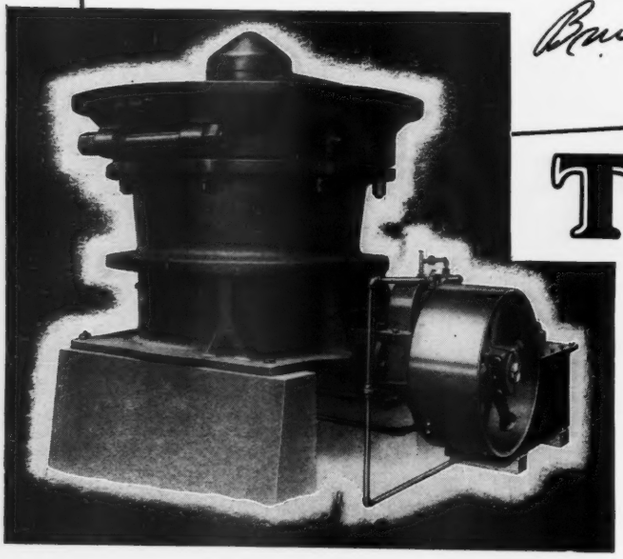
At our Texas Plant, we have a #25-A set with a 3 1/2" opening and one 10-A with a 2" opening to crush the oversize from the 25-A. This is a limestone and the only repairs we have had are one Babbit Sleeve for the 10-A and one Spider Cap for the 25-A. We put this plant in operation in the spring of 1928.

At our Gwynns Falls Plant, we have a 10-A Breaker and 24" cone crusher which has been more than successful as a reduction crusher as this quarry is a very hard gneiss granite. It takes a very good crusher to stand up under this severe work.

Yours very truly,

HARRY T. CAMPBELL SONS' CO.

Bruce S. Campbell
President



WRITE for Catalog C-15.
It gives complete details about the new Telsmith Primary Breaker and the new Telsmith Reduction Crusher.

TELSMITH

SMITH ENGINEERING WORKS

504 East Capitol Drive Milwaukee, Wisconsin

Canadian Representatives
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Montreal, P. Q.

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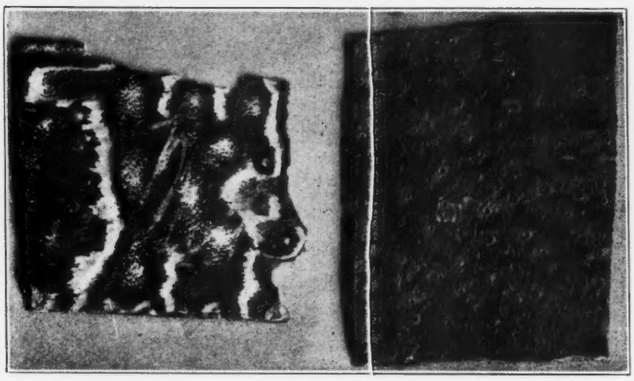
Choctaw C. & M. Co. Memphis, Tenn.	V. L. Phillips Co., Kansas City, Mo.	California Equip. Co., Los Angeles, Calif.

B-22



Above, at the left, plantation sole crepe, a good liner as old-style rubber liners go, but entirely worn out in ONE year.

And LINATEX at the right. Shows no signs of wear after TWO years of service—while the other wore out in half this period.

Try LINATEX next time!

Both of These Liners Looked Nice When they were new...

BUT

NOW... Any liner at most any price looks fine when it's new. But —what is that same liner going to look like two years later, after the toughest of gruelling service? That's the question to consider when selecting an abrasive-resistant liner—and the answer is LINATEX.

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HEWITT-GUTTA PERCHA RUBBER CORPORATION
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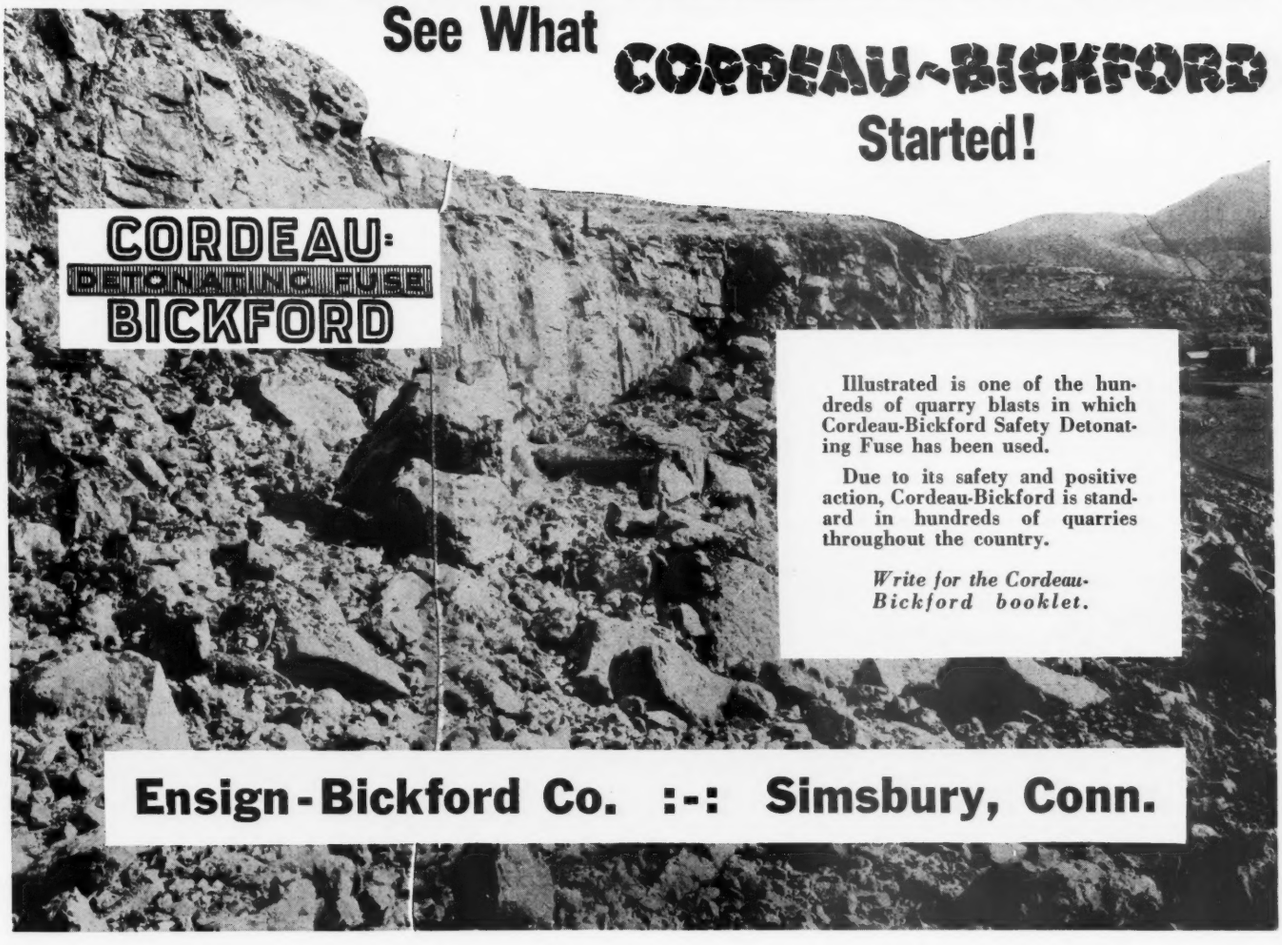
See What CORDEAU-BICKFORD Started!



Illustrated is one of the hundreds of quarry blasts in which Cordeau-Bickford Safety Detonating Fuse has been used.

Due to its safety and positive action, Cordeau-Bickford is standard in hundreds of quarries throughout the country.

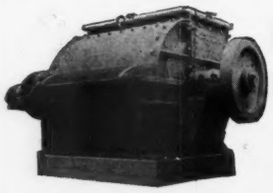
Write for the Cordeau-Bickford booklet.

Ensign-Bickford Co. :-: Simsbury, Conn.

SPECIALIZING IN LIME PLANTS

SCHULTHESS HYDRATORS
SCHAFFER HYDRATORS
McGANN SOBEK KILNS
McGANN YORK KILNS
COMPLETE LIME PLANTS

McGANN MANUFACTURING COMPANY, INC.
Engineers and Manufacturers
CHICAGO YORK, PA. NEW YORK

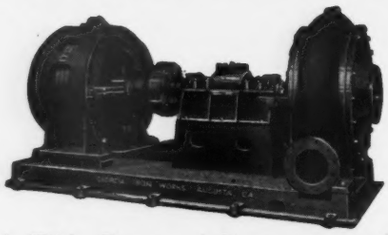


Economical, with Maximum Efficiency

Because of correct design and sound engineering principles, the Gruendler Swing Hammer or Ring crusher is an important factor in economical operation. Roller bearings save 95% on lubrication and 30% to 40% power consumption. Catalog No. 30 explains—*may we send it?*

Gruendler Crusher and Pulverizer Co.
Dept. PQ ST. LOUIS, MO.

SAND AND DREDGING PUMPS



A Wide Range of Sizes, 4" to 14"
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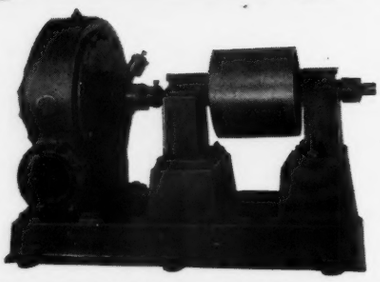
BINKS GRAVEL WASHING NOZZLES
for EFFICIENT ECONOMICAL SAND, GRAVEL and CRUSHED STONE WASHING APPLICATIONS.
Write for Bulletin "G"
BINKS MANUFACTURING CO.
3108-46 CARROLL AVE. Chicago

The Lightning Sand and Gravel Pump



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All sizes — All Capacities
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are built right for Quarry and Gravel Pit

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For *Real* Digging Power

Use the new

WILLIAMS "Champion"

Definitely guaranteed to out-dig any other bucket.

Write us for arrangements to try this powerful digger on your work. Make any tests you want —a real Champion welcomes competition.

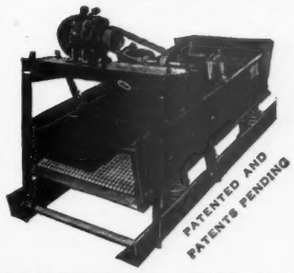
The WELLMAN ENGINEERING CO.
CLEVELAND, OHIO
Branch Offices: New York, Chicago, Pittsburgh, Detroit, Birmingham, Mexico

Write for Bulletin "F," giving full description of this super-bucket.

WILLIAMS
Buckets—Trailers

282

PLAT-O
VIBRATING SCREEN



Produces with high efficiency and accuracy larger tonnages per square foot of effective screening area than any other machine of its kind. Differential conveying action of Plat-O Screen permits operation at very flat angle. Controlled action of screen cloth greatly increases capacity output.

All popular sizes, single, double, and triple deck. Send for our New Bulletin.

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SPIRAL RIVETED PIPE

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1321 North Branch Street, CHICAGO

STANDARD SINCE 1887

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COLLECTING
EQUIPMENT
AIR
ENGINEERING

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MISCELLANEOUS CONSTRUCTION EQUIPMENT: Air Compressors. Gas and Steam Rollers, Pile Hammers, Pumps, Hoists, etc.

CLAPP, RILEY & HALL EQUIPMENT CO.

16 NORTH CLINTON ST., CHICAGO, ILL.
(PHONE FRANKLIN 4028)
WORKS: CLYDE, ILL.

543 UNION TRUST BLDG., PITTSBURGH, PA.
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CONSOLIDATED

GOOD USED CRUSHING, QUARRY and CONTRACTOR'S EQUIPMENT FOR SALE

1—60"x48" Allis-Chalmers, 2—18"x36" Buchanan, 1—30"x15" Traylor Jaw Crushers; also 1—36" Kennedy Gyratory Crusher.

SEND US YOUR INQUIRIES FOR

Complete Crushing Plants; Diesel, Gasoline, Electric Cranes and Shovels; Hoists; Compressors; Pumps; Dragline and Excavating Equipment; and all sizes and types of Jaw, Gyratory and Roll Crushers; Swing Hammer Mills; Elevators; Belt Conveyors; Rotary and Vibrating Screens; Rotary Kilns and Dryers; Raymond and other fine Pulverizers; Air Separators; Hardinge Ball and Pebble Mills; Silex and iron lined Tube Mills, etc. Send for Bulletin No. 12.

CONSOLIDATED PRODUCTS COMPANY, INC.

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Shops and Yards at Newark, N. J., cover six acres

WE WILL BUY YOUR SURPLUS MACHINERY

SAND AND GRAVEL PLANTS

2—Complete electrically equipped Plants, 500 and 800 tons capacity, 90% New condition.

DIESEL FUEL OIL ENGINES

Capacities 75 H.P. to 950 H.P., with or without generators, all modern, some new, bargain prices.

We will pay cash for modern equipment, in unquestionable condition, for contractors, Sand and Gravel Plants, Stone Crushing Plants, etc.

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1524 Chestnut St., Philadelphia, Pa.

LOCOMOTIVES

All Equipped with A.S.M.E. Boilers

60 ton 18x24" Porter 6-wheel saddle tank, 200 lbs. steam.
50 ton 16x24" American 4-wheel saddle tank, 180 lbs. steam.
40 ton 14x22" American 4-wheel saddle tank, 190 lbs. steam.
38 ton 14x20" Porter 4-wheel saddle tank, 180 lbs. steam.
21 ton 11x16" Vulcan 4-wheel saddle tank, 190 lbs. steam.
21 ton 11x16" Vulcan 4-wheel saddle tank, 190 lbs. steam, 36" gauge.

LOCOMOTIVE CRANES

25 ton Browning 8-wheel 50' boom.
15 ton Industrial 8-wheel 40' boom.

GASOLINE SHOVELS

Thew Lorain Model 75-A, 1¼ yard dipper.
P&H. Model 600, 1-yard dipper.

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70—4 yard Western Heavy Duty, 36" gauge.
12—5 yard Western Heavy Duty, 36" gauge.

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HI-GRADE-REBUILT

Motors, Generators, Transformers, Meters, Exhaust Fans, Blowers, Pumps, etc. All standard makes and sizes. Rock bottom prices. Money-back guarantee. Send for bargain sheet.

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Wanted—Reduction Crusher

for use in Eastern Pennsylvania. Reducing 4" Stone to 1" at 40 tons per hour. Must be in good operating condition. Give location, price and complete description. Information desired from owners only. Address Box 1202, Pit and Quarry Publications, 538 So. Clark St., Chicago, Ill.

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3 Yd. Electric, on cats. Full revolving. New 1928.
2½ Yd. Electric, railroad type. Half revolving.
2—50B Bucyrus Electrics, on cats. Full revolving.
Other Electrics 1½ Yd. & smaller, inc. tunnel types.
2 Yd. 50B steam cat. shovel & drag. A-1. $7000.
2—2 Yd. 50 Bs steam cat. shovels. New 1929.
Erie B2 steam cat. shovel, crane, & drag. $1900.
Wilford ⅜ Yd. gas cat. Half revolving. Real buy.
Shovel Attachment for P&H 206. Guaranteed A-1.
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ALL TYPES OF ELECTRICAL MACHINERY. EACH ONE REBUILT & FULLY GUARANTEED.

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3 PHASE, 60 CYCLE

HP	Make	Volts	Type	Speed
1-800	G. E.	2300	Slip Ring	720
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1-300	Al. Ch.	2200	Slip Ring	585
1-275	G. E.	550	Synch.	900
2-200	G. E.	2200/440	Synch.	514
1-200	Wsthse.	440	Slip Ring	500
1-200	F. M.	440	Slip Ring	600
1-200	Wsthse.	220/440	Sq. Cage	585
1-150	G. E.	550	Synch.	720
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REBUILT—GUARANTEED

12—4 c.y. dump cars, steel beam, 4 pedestal.
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1—20-ton American steam locomotive crane, 50' boom.
8—36" ga. gasoline locomotives, 5 to 8 tons.
3—1 c.y. orange peel buckets.

Send for complete list surplus equipment

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Equipment Division
112 North Broad Street
PHILADELPHIA, PENNSYLVANIA

1—40-ton Saddle Tank Vulcan Locomotive, A.S.M.E.
1—220-ft. Portable I.R. Compressor.
1—Browning ⅝-yd. Shovel with 35-ft. Crane Boom.
1—Link-Belt K-35, with 45-ft. Boom. ¾-yd. Bucket.
1—Ohio 35-ton d.d. Loco. Crane, A.S.M.E., 50-ft. Boom.
1—Ohio 25-ton d.d. Loco. Crane, A.S.M.E., 50-ft. Boom.
1—Ohio 25-ton s.d. Loco Crane, A.S.M.E., 50-ft. Boom.
2—Industrial 25-ton d.d. Electric Cranes, 50-ft. Booms.

I buy and sell all kinds of equipment. Send me your inquiries.

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FACTORY REBUILT CLAM SHELL BUCKETS

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1—Haiss 1-yard "Hi-Power" type Bucket.
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PRICED RIGHT—WONDERFUL BARGAINS

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Phone Rittenhouse 6100	Phone Seeley 5100	Phone Grant 6100

CRUSHERS
Allis-Chalmers Gyratory 15-N and 12-K.
Allis-Chalmers 48x36 Jaw Crusher.
Symons Cone, 4 ft. and 3 ft.
Traylor 42x48, 48x60 and 24x36.
Telsmith No. 40 Reduction.
Superior McCully 10 inch Reduction.
Kennedy Gearless Reduction No. 37.
Jeffrey Single Roll 36x54. Jeffrey Pulverizer 36x24.
Allis Chalmers, Blake Type 12x24 Jaw, LOW PRICE.
Good Roads 10x20 Portable and 10x20 Stationary.
Allis Chalmers 8-K, 7½-K, 5-K, 4-K and No. 3.
Austin No. 10, No. 5, No. 4 and No. 3.
Symons Disc 48 in., 36 in., 24 in., 18 in.
Allis Chalmers, Rolls 42"x16" and 36x16.
Stephens-Adamson, All Steel Bucket Elevator, 60'.
Portable Jaw, 10x24, Bucket Elevator, 20 ft.
Portable Conveyors, several sizes.
Stephens-Adamson 30" Belt Conveyor 83'.
Screens, various types and sizes.

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Bucyrus 50-B Comb. 2-yd. LOW PRICE.
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Speeder Comb. Shovel and Drag, ½ yd.
Plymouth Gas Locomotive, 20 Ton, Std. Gauge.
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COMPRESSORS, CARS, LOCOMOTIVES, BUCKETS, BOILERS & POWER EQUIPMENT.

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1—Mundy 125 H.P. 2 drum hoist direct connected to 125 H.P. Westinghouse type C-1 Motor, 440 volts, 680 R.P.M.

1—100 foot Page Mast with all necessary guy lines.

1—2" slackline cable—1,300 feet.

1—1½-yard Sauerman bucket.

Above equipment used 1½ seasons
At Richmondale, Ohio

1—No. 8 A Telsmith primary breaker crusher No. 1239.

1—No. 103 Austin crusher.
At Miami, Hamilton County, Ohio

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Huntington, W. Va.

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16—10 Ton Easton Platform Cars, 6 ft. wide x 10 ft. long.
14—12 yd. Western Hand Dump Cars.
22—12 yd. Western Air Dump Cars.
10—20 yd. Koppel Air Dump Cars.
8—50 Ton 41 ft. Steel Flat Cars.
7—50 Ton 40 ft. Steel Gondolas.
30—40 Ton 40 ft. Box Cars.
36—50 Ton Steel Hopper Cars.

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20 Ton Std. Ga. Plymouth Gas.
40 Ton Std. Ga. American Saddle Tank.
75 Ton Std. Ga. Baldwin with Tender.
6 and 8 ton 36" Ga. 250 V. Electric Locos.

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110 HP Bessemer Diesel Oil Engine with Generator.
Nos. 4½ and 5 Symons Cone Crushers.
10, 15 and 20 Ton Steel Derricks.
Steam and Electric Hoists.
Steel Sheet Piling, Rails, Track.

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IMMEDIATE SHIPMENT
from CHICAGO WAREHOUSE STOCK
6x6 Sullivan WG-6 Air Compressor, belt.
8x8 Curtis type "A" Air Compressor, belt.
9x8, 10x10, 12x10 Ingersoll, ER-1, belt.
300', 427', 647', 2847' Steam Air Compressors with full equipment.
8—350 HP B&W, ASME Boilers with Stokers.
7—150 HP Frost HRT Boilers, ASME 150 lbs.
13x18 Chandler & Taylor Steam Engine.
150, 200, 240, 500 HP Diesel Oil Engines.
No. 1 Gates Gyratory Crusher.
9x16 Western Jaw Crusher.
8, 10, 12, 40 HP Sgl. & Dbl. Drum Gas Hoists.
15—1¼ yd. "V" shape, 24" ga. Dump Cars.
Locomotives, Rail, Truck Loaders, Pumps, Screens, Elevators, Portable Air Compressors, Air Tools, etc.

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Three warehouses with Yards and Shops

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P & H MODEL 206, GAS, CRAWLER, DRAGLINE, 45 FT. BOOM; FULL ENCLOSED STEEL CAB, ¾ YARD BUCKET.

Byers 10 tons Capacity, Full Revolving Crawler, Steam Crane, 40 ft. Boom.

12-Yard Western, Heavy Duty, Steel Beam Type, 2-Way Dump Cars; 19 ft. Beds. NEW BODIES. THE ABOVE COMPLETELY REBUILT AND WE CAN OFFER AT AN UNUSUAL BARGAIN.

HAVE A LARGE ASSORTMENT OF MODERN LOCOMOTIVES, 5 to 100 TONS, ALL TYPES, REBUILT AND READY, STEAM AND GAS SHOVELS, ETC.

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ATLANTA, GA.

Shovels or Cranes
FOR SALE

1—Factory rebuilt Lima 1¼ cu.yd. capacity. This machine can be equipped with either shovel, clamshell, dragline or drag shovel attachments. Very reasonably priced. Carries new machine guarantee. Located at Newark, N. J.

1—GA-2 Erie Gas Air Shovel. Fine condition and bargain. Located Newark, N. J.

General ½ yd. combination shovel, backhoe, 2 buckets, and crane boom. Very good condition. Located Long Island.

1—Type B Erie Shovel or Clamshell machine, good condition. Located Newark, N. J.

Complete shovel attachment for Type "O" Thew. Also, attachments for Type B and B-2 Eries, located in New Jersey. Decided bargains.

1—P & H 1¼ yd. gas shovel. Excellent condition, very attractive price. Located Newark, N. J.

1—Linn Tractor, 6-yd. capacity, with Waukesha Motor. Machine in very good condition. Priced to sell quickly. Located New York State.

1—Koehring ¾ yd. Shovel. Excellent condition throughout. Located Newark, N. J.

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Wire or phone nearest office at our expense.

Revolving Screens

4—48"x20' Allis Chalmers, with 18' jackets, and complete drive equipment (25 H.P. Motors and Tex Rope Drives). ALL BRAND NEW IN APRIL, 1930. Used only eight months. This is the best buy possible in this class of equipment.

Phone or write:

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For Sale

1—No. 7½ McCully Crusher.
1—No. 6 Smith Crusher.
1—No. 5 Austin Crusher.
1—10" Superior McCully Crusher.
1—8" Traylor Crusher.
2—No. 3 Gates Crushers.
1—6" Superior McCully Reduction Crusher.
1—48" Symons Horizontal Disc Crusher.
Several Jaw Crushers.
Gas and Electric Motors, 1 HP to 200 HP.
1—Clipper Well Drill.
1—Clyde 2 Drum Hoist, built for 2 Yd. Drag Scraper, with or without motor.
2—Complete Gravel Washing Plants.

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4603 W. Mitchell St. Milwaukee, Wis.

FOR SALE

One Allis Chalmers Revolving Screen 60" x 12' with 84" x 54" dust jacket and following new perforated screens:

One three foot section		1"	round
Four	" " "	1½"	round
One	" " "	1½"	square
One six	" "	1½"	square
One three	" "	1¾"	square
Three	" " "	2"	square
Two	" " "	2½"	round
Two	" " "	2½"	round manganese
Two	" " "	3"	round
One	" " "	3"	square

One four & half foot section ⅝" square jacket screen.

Price $750.00 for all f.o.b. Dell Rapids, S. D.

L. G. EVERIST, INC., Sioux City, Iowa

Patents Secured to Protect Inventions

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TRADE MARKS

1—No. 3 Gates Gyratory Crusher.
1—No. 7½ McCully Gyratory Crusher.
6—1 yard V Shaped 36" gauge steel Koppel rocker dump cars.
5 Miles 30 lb. relaying rails.
5 Miles 40 lb. relaying rails.
3000 feet 6" Standard Black Pipe 90% new.
2—150 HP Kewanee HRT Boilers 72"x18'.
1—25 Ton Saddle Tank Vulcan Locomotive 36" ga.
1—15 Ton Saddle Tank Vulcan Locomotive 36" ga.
1—12 Ton Saddle Tank Baldwin Locomotive 36" ga.
1—10 Ton Standard Gauge 4 Wheel Browning Locomotive Crane with 35 foot boom.
1—20 Ton Standard Gauge 8 Wheel Industrial Works Locomotive Crane MCB Trucks with 40 foot boom.
1—Worthington Centrifugal Pump 8" suction 5" discharge direct connected to Steam Turbine.

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CHATTANOOGA SALES & EQUIPMENT COMPANY
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GENUINE SPRING STEEL WIRE CLOTH IN DOUBLE and LOCK MESHES

IMMEDIATE DELIVERY FROM STOCK

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GASOLINE DIESEL

JOHN REINER & CO. Inc.
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Shop Overhauling and Emergency Field Service

FOR SALE

1—Steam driven Chicago Pneumatic Air Compressor, 22-16-16.
1— 4' x 12' Receiver. 2—48" x 14' screens.
2—48" x 12' screens.
1—36" x 10' dust screen. All screens for broken stone.
1—Chicago Pneumatic Air Compressor, 3640 cu.ft. capacity to 100 lb. Size 23- 13- 18, belted to 1—625 output, 500 KVA input, 2200 v. 60 cy. 3-phase, Westinghouse Synchronous Motor.

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OVERLOOK MACHINERY SALES

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Offers a complete line of used, rebuilt, reconditioned shovels and cranes at bargain prices. Ask for details on make and size you prefer.

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SAND & GRAVEL PLANT

Complete modern electrically equipped with Sauerman 2½ yd. Slackline outfit, Sauerman 1 yd. Drag Scraper outfit, Telsmith Screen, Plate Feeder, operated a few months, every item 90% new condition.

EAST LIVERPOOL SAND CO.
EAST LIVERPOOL, OHIO

FOR SALE

78C BUCYRUS STEAM SHOVEL Rebuilt; Excellent Shape.

FRAZIER-DAVIS CONSTRUCTION CO.
Arcade Bldg., St. Louis, Mo.

WE LOOK INTO THE EARTH

By using Diamond Core Drills. We drill for Limestone, Gypsum, Talc, Fire Clay, Coal and all other minerals.

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DIESEL ENGINES

1200 IHP McIntosh-Seymour, 6 cyl. Marine type. NEW.
900 HP Nurnberg, also 2—450 HP same. Marine type.
750 BHP McIntosh-Seymour, 6 cyl. Marine type.
600 HP Busch-Sulzer, 6 cylinder. Marine type.
2—320 HP Wintons, marine type, inc. all accessories.
300 HP Fairbanks-Morse, belted type. NEW.
2—120 HP Fairbanks-Morse. 1—100 HP Atlas-Imperial.
120 HP Full Diesel, marine type, inc. propeller, reverse gear, etc. Good general condition. $1250.

JAMES WOOD, 53 West Jackson Blvd., Chicago, Ill.

General Crane 35 ft. boom.
30—4 yd. heavy steel stone skips.
2—1½ yd. 36 in. ga. dump cars.
310 ft., 120 ft. I-R air compressors.
½ yd. General shovel attachment.
3 x 6 Air Receiver.

J. T. WALSH
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WAUKESHA MOTORS

20—Waukesha Heavy-duty "WS" series four cylinder, 80-100-120 H.P. Like new—guaranteed. $950.00 each.
4—Late type Caterpillar Tractors. 30 and 60. Cheap.
1—P & H ¾ yd. capacity full caterpillar electric Crane, A #1 condition. Cheap.

MERTES MACHINERY COMPANY
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WANTED—SHOVEL

1-2½ or 3 yard Late Model Caterpillar full Revolving Shovel, either Steam or Diesel Driven. Price must be right.

Southern Ohio Quarries Co.
Chillicothe, Ohio

FOR SALE

5 New Champion ⅝-yd. Power Shovels and Draglines.

Philips and Davies, Inc.
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FOR SALE

100—50 tons Capacity
ALL STEEL HOPPER DUMP ORE CARS
In Splendid Condition.
Lowest price in years.

DULUTH IRON & METAL CO.
Duluth, Minn.

SWEDISH HOLLOW DRILL STEEL GUARANTEED 100% PERFECT

Considerably below market prices.
20 ton ⅞-in. Hexagon.
50 ton ⅞-in., 1-in., 1⅛-in., 1¼-in., and 1⅜-in. Round, Hexagon and Quarter Octagon.

MARINE METAL & SUPPLY CO.
167 South St. New York City

FOR SALE

1—Three Drum Lidgerwood Steam Hoist.
1—Two Drum Lidgerwood Electric Hoist.
1—22-Ton Gas Standard Gauge Locomotive.
1—4-Ton Gas 24" Gauge Locomotive.
Speed Reducers—Boilers.
Compressors—Portable and Stationary.
Screens, Conveyors, Pumps of all kinds.

THE W. T. WALSH EQUIPMENT CO.
12500 Berea Road, Cleveland, Ohio

SAND AND GRAVEL

Sand and gravel bed, high grade. State-accepted, large acreage in Central New York, on D., L. & W., for development or disposition; water and natural advantages for profitable mining; good markets; only financially able solicited.

C. NOBLE
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FOR SALE CHEAP

Complete Sand & Gravel Dredge, consisting of barge, 12" Amso centrifugal Pump, 250 H.P. G.E. 2300 V. Electric Motor, pipe line, hose, Manganese Flap Valve, electric cable, etc. $3,250.00.
O & S—¾ Yd. caterpillar crane with clam shell and dragline buckets. $1,500.00.

HAWARDEN GRAVEL CO.
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POSITION WANTED

Superintendent, 20 years' practical experience in construction and operation of crushing, washing and pulverizing plants. Competent in quarry and pit operation. Thoroughly experienced with all type plant and power equipment. Efficient material handling and organizing of operating crew for minimum production cost. Available now. A1 References. Address Box 804, Pit and Quarry, 538 S. Clark St., Chicago.

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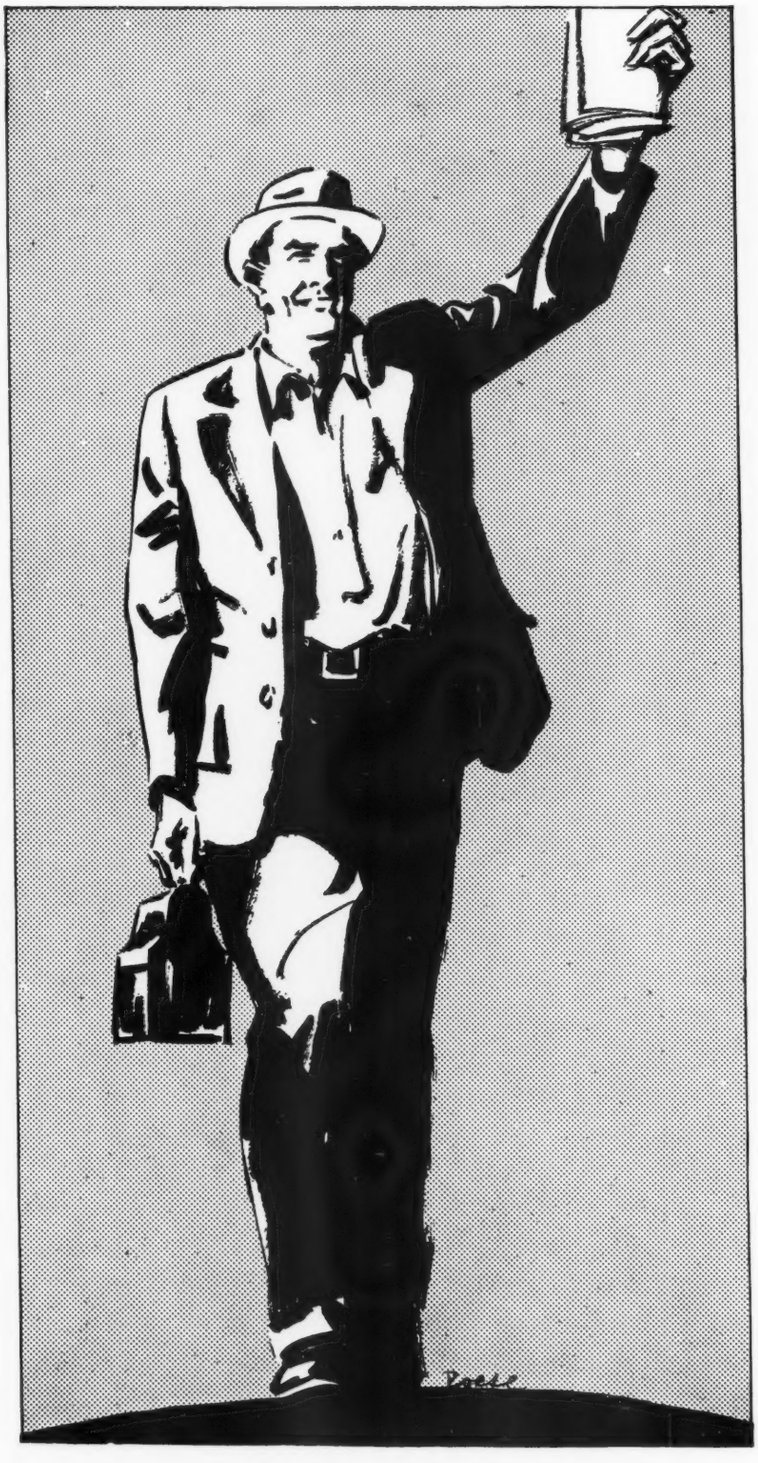
"Wants" and

Surplus Equipment

Keep his head up

and we'll all come through!



You recognize this man. He lives in your own town, not far from you . . .

Though faced with unemployment, he is combating adversity with courage. He has retreated step by step, but fighting. He has spread his slender resources as far as they will go.

This winter he and his family will need your help.

There are many other heads of families much like him in the United States. This winter all of them will need the help of their more fortunate neighbors.

This is an emergency. It is temporary. But it exists. It must be met with the hopefulness and resource typical of American conduct in emergencies.

Be ready! Right now in every city, town and village, funds are being gathered for local needs—through the established welfare and relief agencies, the Community Chest, or Special Emergency Unemployment Committees . . .

The usual few dollars which we regularly give will this year not be enough. Those of us whose earnings have not been cut off can and must double, triple, quadruple our contributions.

By doing so we shall be doing the best possible service to ourselves. All that America needs right now is courage. We have the resources. We have the man power. We have the opportunity for world leadership.

Let's set an example to all the world. Let's lay the foundation for better days that are sure to come.

The President's Organization on Unemployment Relief

WALTER S. GIFFORD

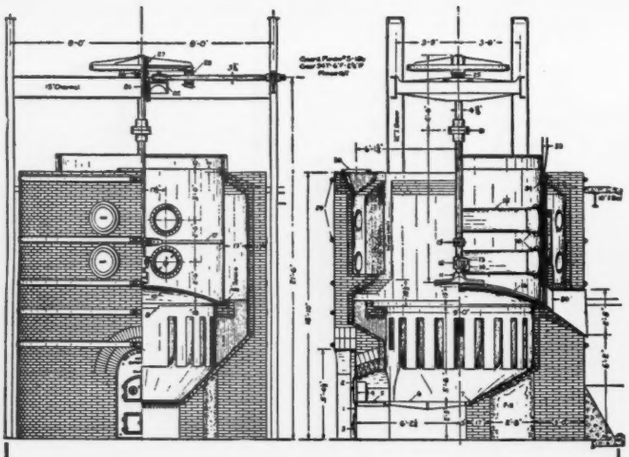
DIRECTOR

Committee on Mobilization of Relief Resources

OWEN D. YOUNG

CHAIRMAN

The President's Organization on Unemployment Relief is non-political and non-sectarian. Its purpose is to aid local welfare and relief agencies everywhere to provide for local needs. All facilities for the nation-wide program, including this advertisement, have been furnished to the Committee without cost.



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When you install Ehrsam Kettles you have made the best buy possible from the standpoint of efficiency, economy and production. Gypsum plant operators everywhere recognize Ehrsam Kettles as a real interest bearing investment.

You will readily see why, when you read the complete description of their superior design in our literature. Send for it today.

We also manufacture Mixers, Rotary Crushers, Fine Grinding Mills, Elevating and Conveying Machinery, etc.

The J. B. Ehrsam & Sons Mfg. Company
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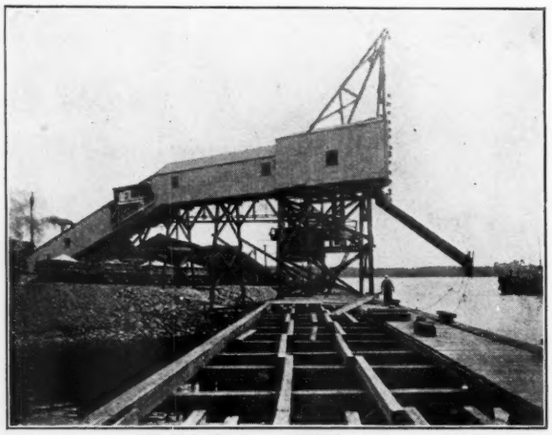

Merrick Conveyor Weightometer
Weighing Stone to Boats

The Merrick Conveyor WEIGHTOMETER!

Will weigh within a guaranteed accuracy of 99% any material passing over a conveyor upon which it is installed, and doing it without additional handling, expensive labor, or loss of time.
Weightometers are ideal for weighing stone, gravel, sand, coal and hundreds of other conveyor-handled products.
When properly installed it does its work faithfully and correctly—requires little attention. Write for full details.

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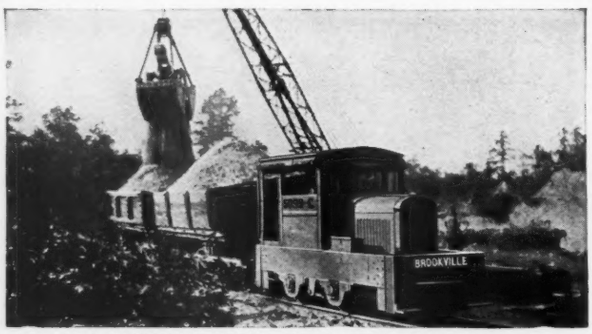

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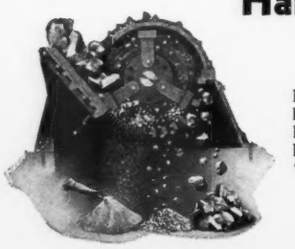

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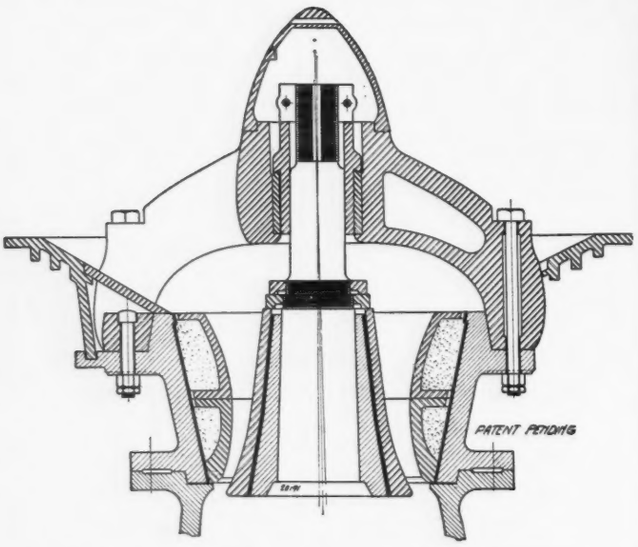

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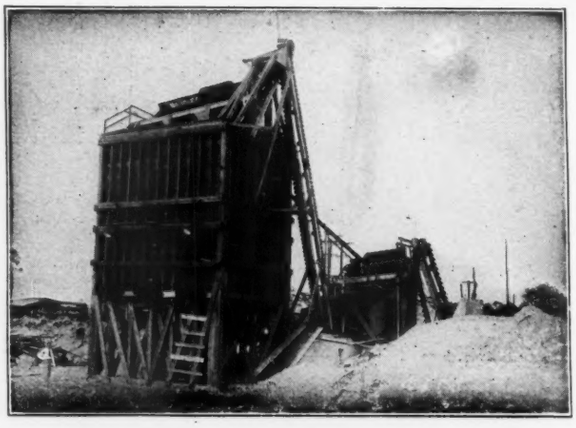

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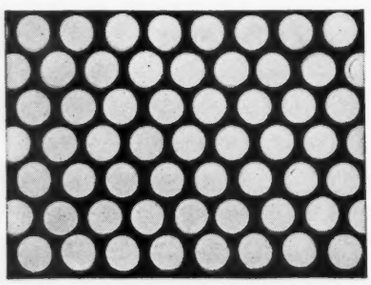

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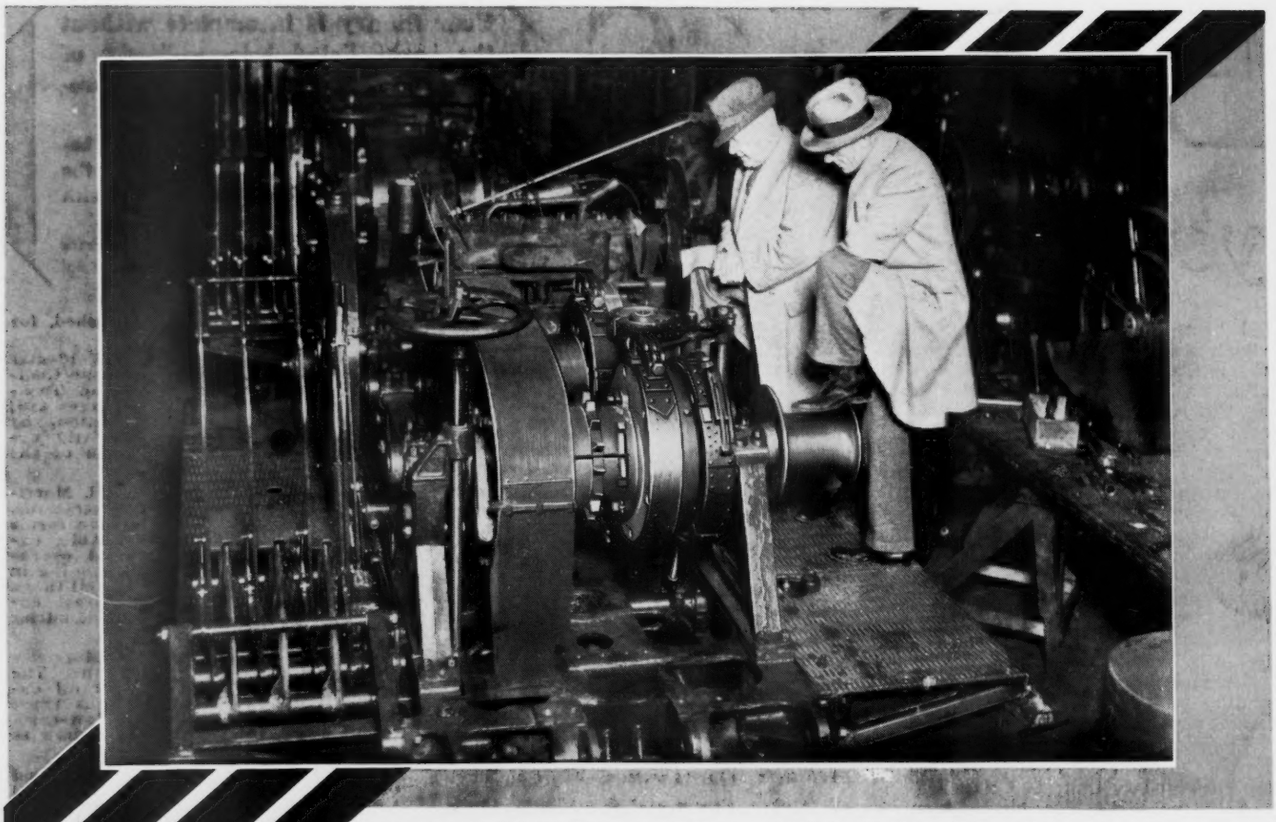

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